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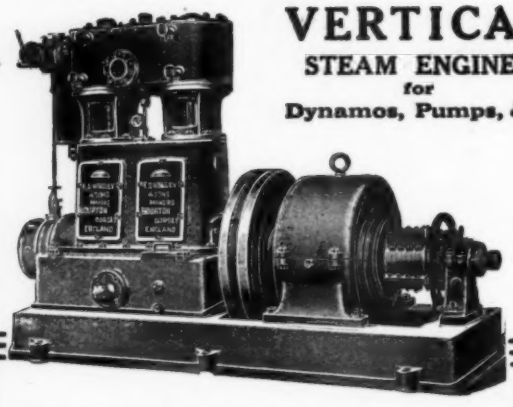

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The

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The Register of Electrical Contractors.

SIX months ago (ELEC. REV., February 8th, p. 202), when recording the setting up of the National Register of Electrical Installation Contractors, we expressed the hope that the scheme would receive the cordial support of all contractors falling within its scope. We are therefore pleased to learn that within a period of only six months the Board is able to report that 500 names have been accepted for registration. This first Official List we are placing on record on the "Contractors' Column" page in the Advertisement Section of the REVIEW. An instalment appears to-day, and the remainder of the entries will be published on August 1st and 8th.

There is no need to review again the many circumstances that have combined to render this movement desirable in the best interests of the electrical industry as a whole and of electrical installation contracting work in particular, but the present time, when the operations under the scheme are being pursued with zest and when some thousands of other electrical contracting businesses in the United Kingdom must have the matter under consideration, seems an opportune moment for reminding our readers that registration under the scheme is open to all who are possessed of equipment, practical business experience, or theoretical and practical training, rendering them competent to follow the calling of electrical contractor; or, in the case of companies, firms, and electricity supply undertakings, to all which employ a manager who is thus qualified. The scheme does not close the door of the trade against new-comers, for new entrants can be registered subject to suitable safeguards. An average standard of good workmanship has to be maintained, and unless there is a measure of integrity and financial stability the improved status that everybody should desire cannot be reached. It goes without saying that registration imposes compliance with the rules and conditions of the Register. Those who are unfamiliar with the qualifications that are required of them in order that they may be able to carry the hallmark of registration will find the details set out fully in our issue of February 8th, 1924, p. 212. It may be repeated here that contractors whose names appear on the Register are entitled to use the words, "Registered by/under the National Register of Elec-

trical Installation Contractors," "National Registered Electrical Contractor"; or the letters "N.R.E.I.C."; and also to use the standard mark or device of the National Register. Certificates are renewable annually, and the Board, which is composed of representatives of the I.E.E., the I.M.E.A., the E.C.A., the B.E.A.M.A., the Electrical Wholesalers', Consulting Engineers', and Architects' organisations, has power to revoke or cancel the certificate of any contractor who fails to comply with the rules and conditions.

We congratulate the Executive Committee upon the success that has so far attended its efforts, for the scheme is unquestionably one deserving of support from all who desire to maintain or to improve the quality of electrical installation work and the status of those connected with the trade. The Committee's operations, as may be imagined, have not been free from anxiety and difficulty, for the work of investigation has to be most carefully performed so that admission shall not be denied to any who merit it, or its privileges granted where there is any room for believing that they should be withheld. Without a fairly searching examination of the details, the hall-mark carried by registration would be valueless.

The Decisions of the Electricity Commissioners.

In our leader last week we referred to a discussion at the I.M.E.A. Convention in which recent actions of the Electricity Commissioners were severely criticised and said to be "against the weight of evidence." Our comments on this subject were intended to show that the Electricity Commissioners were a judicial body, and should be treated as such, and our reference to a "disappointed litigant" was to draw a parallel in general terms. We learn that in some quarters it has been assumed that we had in mind the litigation in which the Ealing Corporation is concerned; this, however, is a wholly erroneous impression. Although the Corporation has very strong feelings with regard to the matter in which it is opposed to the Commissioners, so far as we are aware, neither the Corporation nor any of its officials has at any time attacked their decisions except, of course, in Court, nor has it sought the aid either of the I.M.E.A. or of the London Conference of Municipal Authorities in its conflict with them.

The French Electrical Manufacturing Industry.

Dealing with the progress made in recent years by the French electrical manufacturing industry, a correspondent of the Paris *Information* recalls the fact that although a remarkable development began in 1900, the country still had to import, particularly from Germany, dynamos, electrical apparatus, lamps, cables and wire and accumulators and batteries of the total value of 34,000,000 fr. in 1913. The manufacturing industry in 1913 had available a capital of slightly more than 300,000,000 fr., but in 1923 the capital resources had grown to over 1,500,000,000 fr., and the productive capacity of the works had risen by from 300 to 500 per cent. Under these circumstances it is now possible for the dynamo makers to place on the market machines of the value of 300,000,000 fr. per annum as against 70,000,000 fr. ten years ago; the cable and wire industry, products of the value of 100,000,000 fr. as compared with 40,000,000 fr.; and accumulators and primary batteries have made similar progress. In the case of electrical apparatus, of which makers were only able to supply a quantity representing 45,000,000 fr. in 1913, the exports in some years since the armistice have amounted to 100,000,000 fr. per annum. Taken as a whole, the manufacturing industry now has a capacity for supplying products worth 1,200,000,000 fr. per annum as contrasted with only 200,000,000 fr. ten years ago, and it is noted that not only has the production been increased, but also that new manufactures which were formerly not turned out are now being made by French works. Thus, for instance, when the Compagnie du Midi undertook the initial electrification of its lines in the Pyrenees, it was compelled to have recourse to foreign insulators. At present, however, there are works which are sufficiently well equipped to supply the whole of the national requirements in electrical porcelain, and to engage in export trade as well. Simultaneously the wireless telegraphy and telephony branch has received an exceptional impetus. Before the war, Germany had succeeded in inundating France with metallic filament lamps, but the efforts made from the same source to regain the French market since the end of hostilities have failed. It is considered that the development which has taken place in recent years permits France to proceed with the electrification of the railways and of the country districts without having to obtain a large portion of the necessary equipment from other countries. The remarkable results obtained have been due to a concentration of efforts and of plant, and have necessitated large appeals to the investing public. The writer of the *Information* article states that the country is now not only able to dispense with making purchases from abroad, but it is also equipped for supplying many markets which were until recently monopolised by the Germans. The only fear appears to be of American competition, although the dollar quotation will protect the French works against this eventuality for a time.

Electricians' Strike Threat.

The national ballot of electricity supply workers, which shows a majority of 3 to 2 in favour of a strike policy rather than reference to arbitration upon the demand for 10s. a week increase, brings us once more within sight of a serious disturbance extending throughout the social and industrial affairs of the nation. The executives of the trade unions concerned, some forty in number and representing 29,000 men, are to meet on July 30th to consider the next move. It is reported that some of the Unions voted against the strike policy, which was upheld mainly in London and South Wales.

We hope that the question at issue may be solved without recourse to a strike, which, if effective, would throw out of employment a vast number of workers who have no voice in the dispute, and would entail immense inconvenience and loss to the whole of the community.

The Electrical Power Engineers' Association has had no part in the matter, but would necessarily be affected if the manual workers' Unions decided to strike. As the latter have rejected arbitration, the attitude of the E.P.E.A. will no doubt be dictated by the principle to which it has declared allegiance—namely, that the continuity of the public service must not be involved until every alternative means of arriving at a settlement has been employed.

Electricity in Parliament.

Events are drawing to a head in respect of Parliamentary intervention in the field of electricity supply. The Liberal report on "Coal and Power," on which we commented last week, aroused considerable interest in political circles, and the memorandum of the Labour Party, which we also dealt with, foreshadowed a determined attack upon the Bills which, with the approval of the Electricity Commissioners, have passed through the House of Lords and were due for second reading in the House of Commons this week. The Government also has views on the matter, which apparently are hardly ripe for publication, but its hand is being forced by circumstances, and although the consideration of the Companies' Bills has been postponed, they will probably have to be dealt with next week.

It is rumoured that the Cabinet has abandoned the idea of nationalising the supply of electricity, as being hopeless of attainment, and will instead propose to endow the Joint Electricity Authorities which are in course of formation with compulsory powers to enforce the unification of electrical generation and transmission. That some such action will be taken seems almost inevitable.

The World Power Conference at the British Empire Exhibition.

(Continued from page 91.)

Preparation of Fuels.

This section of the Conference, over which Dr. D. S. Jacobus presided in Hall III, on the morning of July 3rd had presented to it a long series of papers dealing with the subject of low-temperature carbonisation and the production of oil fuel. It was the intention to continue the discussion upon these papers in the afternoon, but the subject was so exhaustively dealt with at the morning sitting that it was decided—on the motion of the prospective Chairman of the afternoon's sitting, Mr. B. F. Haanel (Canada)—to cut the afternoon meeting out and spend the time in a visit to the Fuel Research Board's exhibit in the Exhibition.

In broad principle, the subject of low-temperature carbonisation for the production of a smokeless fuel, a fuel for industrial purposes, gas, and oil is not of immediate electrical interest, although, of course, it is one of the developments likely to be of considerable importance in relation to generating stations at some future date. The subject is one which has received a vast amount of attention during the past 20 or 25 years, to the regret of many people who were induced to put money into concerns at a stage when the fundamentals of the whole subject were not understood. Things, however, have improved very much in recent years, and there are many processes on the verge of practical and economic operation. At the same time, even the Fuel Research Board is ready to say that there is as yet no process which can really claim to have reached this stage. One of the chief points made in the discussion was that the chemist and the engineer should get together and endeavour to solve the problems involved, in a really scientific manner. That is being done to a much greater extent than formerly, and to that circumstance may be ascribed the more rapid progress made during the past ten years in the desired direction. There are, however, those who claim that the necessary degree of co-operation is still lacking, and the Fuel Research Board itself, in a paper by Prof. H. E. Armstrong, was accused of having spent a sum of £400,000 upon this problem without bringing us a step nearer the desired goal.

This attack naturally brought Dr. C. H. Lander, of the Fuel Research Board, to his feet with a denial of the suggestion that concerted and co-operative action had not been taken, and, at the same time, with something of an apologia, for it was said that there were so many roads to take in dealing with this problem that difficulties were bound to arise. Moreover, the simile was advanced that whereas in the case of ship or bridge construction, the fundamental principles and requirements could be worked out on a model scale, from which could be deduced what was required on the full-size scale, that was not practicable with low-temperature carbonisation. Everything must be done on the full-size scale from the beginning—hence the troubles and tribulations of the past.

The one thing made clear by the papers and discussion, however, was that in all the leading countries of the world very considerable progress has been made of late in this very intricate subject, with somewhat greater daring on the part of those in the United States and Canada where, perhaps, the problem of dealing with low-grade solid fuels is a more pressing one than here. In Canada, especially, the bulk of the coal used is imported, and anything which can be done to obviate the necessarily heavy cost will be of immense advantage.

There were differences of opinion among the various speakers as to the advisability of regarding low-temperature carbonisation primarily from the point of view of the solid fuel to be obtained or from the point of view of the oil fuels obtainable, but as the processes for the most part are more or less elastic in that they can be operated with the eye mainly on one or the other, perhaps this point is not of outstanding importance. There is this feature about it, however—that the oil experts predict that the United States will not be producing any natural oils in 25 years' time, and that therefore attention should be concentrated on the production of oils from the distillation of solid fuel.

Dirt in Coal.

A point of considerable, and even painful, interest to power-station engineers, which arose during the general discussion, which covered the whole field of fuels, was the very pertinent question of reducing the amount of dirt now sent out by the collieries for which such high prices have to be paid. Prof. Armstrong put the question point blank to Sir Richard Redmayne, one time chief inspector of mines and now closely associated with the coal industry. Sir Richard hedged; he said that when trade was bad with the collieries the amount of dirt sent out was less than when trade was good, on the hypothesis that in the hurry of keeping pace with the demand there was less time to think of cleaning the coal. This gives little satisfaction to the unfortunate buyer, be he large or small, who has less influence in the matter than the foreign Government that Sir Richard Redmayne told of, which, during the war, insisted on buying upon a calorific-power basis for gas-making purposes. The result was the issue of one of those familiar circulars from the Coal Department warning the collieries that they must pay more attention to the cleaning of their coal in future. One of these days the large industrial users and the coal owners will get to a round-table conference on the matter; perhaps at the moment the owners think they are in bad enough straits without voluntarily making their position worse by removing the large percentage of useless material for which they can now get a good price. An American delegate put the whole position in a nutshell when he reminded the meeting that the removal of dirt from coal should take place at the bottom of the pit, and that expensive machinery should not be installed at the pit-head to deal with it after, in addition, the expense of loading this useless material, with the good coal, into the wagons and bringing it to the surface.

Pulverised fuel also came in for some discussion, but two very lively questions, put by Dr. D. S. Jacobus (U.S.A.) as to the cost of pulverising fuel and whether it could be stored after it was pulverised were left over until the following morning, when the discussion of the whole subject of fuels was resumed.

Pulverised Coal.

Before dealing with the half-dozen papers set down for consideration that morning (July 4th) by this Section, dealing with peat, wood waste, and similar forms of fuels, some time was taken up with pulverised fuel, particularly in relation to the two questions mention above. Ing. Oskar Taussig was in the chair.

Mr. A. E. Douglass, manager of the Pulverising and Crushing Department of the Fuller-Lehigh Co., which concern is one of the leading manufacturers of pulverising plants in the United States, said that pulverised coal had been handled for 22 years in such industries as the cement industry—which first demonstrated the possibilities of pulverised fuel. There were now approximately 25 million tons of fuel pulverised in the United States annually and, taking 26 of the latest

plants, the average cost of crushing, exclusive of capital charges, was 45 cents per ton on a plant of 100 tons' capacity per day, and this was reduced to 40 cents with 200 tons; 36 cents with 400; and for 1,000 tons per day and over the cost was slightly under 32 cents per ton. These were average figures for anthracite, lignite, and bituminous coals. As to storing, it was stated that pulverised coal had been stored for as long as seven months without spontaneous combustion, and that provided suitable bins were used, no fear on this account need be felt. Mr. Douglass admitted that for small plants even his enthusiasm for pulverised fuel would not permit him to put it forward as the most suitable, especially where a supply of good solid fuel was available more or less on the spot. Nevertheless, he was anxious not to let it be thought that the figures of cost he had mentioned were additional to the cost when using other than pulverised fuel because, as he was careful to point out, when using stokers there was power to drive them, repairs, &c., to be taken into account, and he alleged that, on balance, pulverised fuel showed up best in this respect.

An interesting contribution to the discussion was made by Dr. B. F. Haanel (Canada), who is well-known in connection with fuel problems there. It was distinctly of interest to be told that the Ontario Hydro-Electric Commission was contemplating putting down a steam plant as a stand-by to help to carry the peak loads, the capacity of this plant being 100,000 h.p., and a little doubt was felt as to whether to use pulverised coal or gas for steam generation.

The paper by Prof. Purcell on peat, and the two papers on wood waste did not draw any discussion of note, although Prof. Purcell was corrected in the matter of some figures in his paper of peat areas in Sweden.

Steam Utilisation—Turbines.

The morning session in Hall II on July 4th dealt with the improvements made in recent years in the efficiency of the steam turbine for land and marine purposes. Mr. John W. Lieb presided, and, in remarking that that was one of the most important sessions of the Conference, referred to the important influences of the performance of materials, and obsolescence; in the desire to attain the highest degree of efficiency, he had personal experience in American practice of the scrapping of costly equipment which had hardly seen enough service to have been tuned up to give its best performance. Even more important than high efficiency or economy of operation was reliability in service, the attainment of which must be a fundamental principle in the design of central station machinery. It was the primary duty of those who were responsible for filling public needs to see that the confidence of consumers in continuity and reliability of service was not misplaced. There seemed to be a tendency to seek a compromise between the impulse and reaction types of turbine; in America the placing of one order for three or four sets of 50,000 kW each was not unusual, while a single set of 100,000 kW was in the minds of designers at the moment.

Four papers were considered, by Sir Charles Parsons, Mr. C. F. Stork, Mr. V. Nordström, and Mr. F. Hodgkinson respectively. Sir Charles Parsons opened by reading a synopsis of his, remarking that the turbine commenced its development for land purposes in 1884; though it earned at first the name of "steam-eater," it soon improved, and by 1892 was able to rival the best reciprocating engines in economy of steam and coal for the generation of electricity. At that period it also entered into the field of marine propulsion. On land, turbo-electric generating units had been developed to very large sizes, and even large direct-current generators could now be turbo-driven. Electric power stations using steam turbines had been designed for a capacity of 500,000 kilowatts. Land turbines, having developed under less restrained conditions than those on board ship, had led the way in economy of steam, and every means had been explored to render large power plant for the generation of electricity as thermally efficient as possible. Considerable advance in that direction was being made at the present time. He alluded to the reduction in steam consumption which had been effected, and to the increasing field of its application. It was estimated that the output of steam turbines, both land and marine, had now reached the great total of over 120,000,000 horse-power, and the 60,000-kW turbo-generator being built at Newcastle-upon-Tyne for installation at Chicago would have an overall thermal efficiency from the coal to the electrical side of 27.6 per cent.

Mr. Junkers, of the American General Electric Co., outlined the activities of his firm, which had always appreciated the advantage of large sets. He enumerated the number and types of machines now being built by the G.E.C. for land use, the total capacity being 460,000 kW. Research work was taking place in connection with the action of steam in nozzles and buckets, but the greatest advance was looked for in the use of high steam pressures and temperatures; one set, which would be in service this year, was being constructed for a steam pressure of 1,000 lb. per sq. in. and a temperature of 700 deg. F.

Dr. S. Z. de Ferranti had not intended to take part in the discussion, but at the request of the chairman explained that in 1902 he came to the conclusion that the best arrangement was a re-heating turbine, the great thing being to use a cycle in which the whole of the work was done at the top temperature. After experiments he built a 3,000-r.p.m., 3,000-kW turbine in 1910 on the Parsons blade system with no dummies; there were two stages with regeneration between the exhaust and the condenser, the machine being later arranged for bleeding at four stages. It had two drums, the blades being welded in, and the machine supplied power to the Vickers works at Sheffield. Alloy steel, 25 per cent. nickel, heater tubes were used (no little difficulty being experienced in producing them), the heater being between the boiler and turbine, all close together. The turbine gave wonderful results as regarded economy. He had also constructed an internal-combustion turbine, several small wheels having been made against which gases from a combustion chamber impinged. It worked well, but the wheels ran at a red heat, the measured temperature having been about 900 deg. C.

Mr. B. Pochobradsky thought that the research work of the "Beama" and the Institution of Mechanical Engineers had shown a "new law of steam flow," which suggested a new line of design. That was, if efficiency was to be obtained, that only the very low and very high velocities should be used. The small diameter of the h.p. stage, however, would lead to a very high pressure within it, especially with the high boiler pressures now being introduced; he therefore proposed, in order to keep the casing tight, to use an inner casing fixed to the outer one flexibly, the steam pressure between the two being held at some medium point between that of the h.p. stage and the atmosphere. The outer casing would be kept cool by the circulation of steam from the l.p. stage between the two casings.

On the chairman caling for the views of manufacturers, a representative of the English Electric Co., Ltd., said he thought the American paper had been rather hard on the impulse type of turbine, and with regard to methods of fastening blades he considered that the American G.E.C. system was the best. A representative from Trafford Park referred to the tests (see ELEC. REV., July 11th, p. 82) of a Metropolitan-Vickers 7,000-kW 3,000-r.p.m. machine at Bristol which gave a corrected steam consumption at 80 per cent. load of 11.021 lb. per kWh, 2.4 per cent. better than the guarantee; the machine was provided with a multi-exhaust, which gave the same efficiency but with a lower vacuum. As representing consulting engineers, Mr. Geo. Orrok (U.S.A.) said he had hoped to hear something from the Continental designers. There was great variation in design, but the uniformity in guarantees was astonishing. What they wanted was reliability and ability to start quickly from cold.

From the users' point of view, it was pointed out that when cost was being considered, the multiple and

single case machines should be compared; the former gave better economy, but how much did it cost? The economy obtained must be such as to balance the increased capital expenditure in from 3 to 4 years. In this country users were thankful for the standard periodicity of 50 cycles, because the speed of 3,000 r.p.m. could not be exceeded. An American delegate suggested that much of the money spent on obtaining one or two points of extra efficiency could often be made better use of for providing additional capacity, while Mr. Bernard Price (South Africa) pointed out that the cost of fuel, which varied in different parts, needed to be taken into consideration when discussing efficiency, and also that the cost of maintenance was of importance when the plant was installed in a country far distant from the factory wherein it was made.

In reply to the discussion, a representative of Sir Charles Parsons expressed the opinion that the suggested double casing was unnecessary, even with the highest pressures, provided the h.p. stage was made small enough, which involved a high speed and the use of gearing between the h.p. and l.p. parts of the machine. Users apparently wanted something for nothing; but manufacturers were giving them that in so far as the adoption of high steam pressure and temperature called for less boiler heating surface. The chairman, in closing the debate, said that reliability could be obtained, if the price were paid, by large concerns at any rate.

Illumination.

The afternoon of Friday, July 4th, in Hall II, was devoted to the subject of Illumination, papers being presented by Mr. J. W. T. Walsh, Mr. L. Gaster, and Mr. C. W. Sully. Being somwhat lengthy, the papers were not read *in extenso*, but only briefly summarised by the authors. Mr. Walsh's contribution on "International Co-ordination in Illumination," and Mr. Gaster's on "The National and International Aspects of Illuminating Engineering," were useful as giving a survey of developments abroad, appropriate to a World Power Conference, and Mr. Sully's "Progress in Electrical Illumination" was a very comprehensive effort, containing a considerable amount of detailed information. Mr. Walsh pointed out that the work of the International Illumination Commission was only in its infancy, although it had already done useful work in connection with standards and units, &c. But other more practical questions such as codes of lighting in schools and factories, automobile headlights, &c., were now being taken up. Mr. Gaster showed how the Illuminating Engineering Society, whilst acting as the guardian of the public interests in matters of illumination, was constantly seeking the aid of other bodies and forming new connections. He referred particularly to the work of the committee operating under the Department for Scientific and Industrial Research, and of the newly-constituted committee on standardisation under the B.E.S.A. In reviewing progress in industrial lighting, he endorsed the principle that conditions of working illumination should be determined by consultation with the industries concerned. Mr. Sully's paper dealt in turn with the evolution of the electric lamp, general principles of illumination, applications in the home, offices, factories, streets, &c., and possibilities of expansion. As illustrating the advance in the use of artificial light, it was mentioned that the average wattages of lamps sold in the United Kingdom during 1912, 1917, and 1922 were respectively 36.1, 48.8, and 57.4 watts.

The discussion was chiefly concerned with the problem of the best way to interest the public in lighting matters. Dr. Clayton Sharp, a past-president of the American Illuminating Engineering Society, remarked that it was rather singular—considering that, according to recent estimates, about half the electric power produced was used for lighting—that only three or four papers, out of the vast number presented at the World Power Conference, dealt with illumination. Mr. C. C. Paterson suggested the desirability of special contributions to the cost of wiring in cases where the installation was planned to ensure adequate illumination, and Mr. J. S. Dow urged the initiation of more inquiries and experiments at home and abroad in order to obtain statistical data, such as were very useful in approaching consumers. A number of others associated with leading electrical firms joined in the discussion; but it was generally remarked that—doubtless owing to the fine weather and the counter attractions outside—the Conference was not much patronised by the general public, whose interest in illumination it was desired to arouse.

Power Transmission and Distribution.

The subject of debate in Hall I on the morning of July 7th was the transmission and distribution of power. Mr. John R. Freeman (United States), past president of the American Society of Civil Engineers, presided, and 18 papers were considered, but the discussion was somewhat disappointing, as there were only three or four speakers, practically the whole morning being devoted to the reading of abstracts of the papers.

The fact that the economic side of power transmission was not perhaps appreciated as much as it ought to be, was of importance, inasmuch as the concentration of generation in large stations, in an endeavour to save coal, necessarily involved longer transmission distances. The generating plant and systems of transmission and distribution in a mining area in France were described in some detail, after which Austrian delegates outlined the present position of power production and distribution in Austria and the policy of the Styrian Water Power and Electricity Co., which included the development of water power to replace steam stations, the latter to be restricted to the carrying of peak loads. A network of h.p. pole-supported lines was being erected, the various districts being interconnected, in the construction of which the ice loading of the conductors was a ruling factor; a safety factor of 2½ had been adopted. The adverse Austrian trade balance was said to be due to the necessity for importing expensive coal, but the development of water power would remedy that state of affairs. In Styria the co-ordinated stations would have an installed horse power of 450,000; the first generating station would be completed by the end of this year, and the distribution system would be at a pressure of 60,000 volts.

The electrification of Holland was the subject of a paper by the High-Pressure Committee and Mr. F. A. Smit Kleine, who explained that in 1905 all the electricity undertakings in that country were owned by municipalities, but that in 1908 provincial concerns were formed, each having its own "island" area of supply, and furnishing energy in bulk either to the communities or to individuals. There were now 26 generating stations each of from 3,000 to 80,000-kW capacity, and some 90 per cent. of the 10,000-volt feeders were underground cables, the remainder being overhead lines. When planning the system, the load had been assumed to be uniformly distributed over the whole country, which was divided into areas each having a centre of feeding from the 10,000-V system. When the primary pressure was under discussion it was found that the difference in advantage between 100,000 and 50,000 volts was very little; accordingly, the lower was chosen for the densely-populated industrial centres. In certain districts the nature of the soil made foundations for pole lines very expensive, and therefore a voltage had to be chosen which would be suitable for use with cables as well as with overhead lines. The 50,000-V cables in use were of two makes—Messrs. Callender's and Messrs. Siemens-Schuckert's—and had worked well since November, 1923; in fact, experience had proved that they gave less trouble than did the 10,000-V cables. A beginning had been made with the electrification of the railways on the 1,500-V d.c. system, power being obtained from the general system. With regard to the interconnection of generating stations, they had found no general solution of the problem; each case had to be considered on its own merits, but there were undoubted advantages with respect to light-load periods and week-ends.

The paper by Messrs. Julian C. Smith and C. V. Christie dealt with the transmission and distribution of electric power in Canada, in which country the jurisdiction of the Board of Railway Commissioners, ex-

plained Mr. Christie, embraced wires of all kinds which crossed, ran along, or even came near railways. Perhaps the greatest work the Board had done was to bring together power, railway, telegraph, and telephone engineers, who thus together solved problems and made plans acceptable to all concerned. It had taken 18 years to reach that stage, but there had not been a single failure of a crossing planned in that manner.

The transmission of electric power from Norway to Denmark was spoken of by Prof. Wm. Rung, who pointed out that overhead conductors had to be adopted because the width and roughness of the crossing rendered the use of submarine cables impossible; the efficiency of the system was estimated to be of the order of 75 per cent. Mr. S. Kloumann, in dealing with the subject of exporting power from Norway, explained that every concession for the development of hydro-electrical energy in that country forbade the export of power. Nevertheless, he contended that the country possessed a sufficient surplus of water power to make it advantageous to export some of it. The world had lived rather freely on its coal resources, and there was no reason why water power should not be exported to neighbouring States which had none, and had little coal. The U.S.A. had planned a "super-power" system for the whole country, and why had not something similar been done in Europe? Of the several reasons, the greatest was a political one, but as coal mining was the worst kind of human labour, it would become increasingly difficult in the future to win enough coal to satisfy the world's demands. European countries should co-operate for the satisfaction of their power needs, but in order to be a success, exported power should take the basic load all the year round, and not be utilised only to meet peak demands.

The influence of voltage regulation on electricity as a factor of quality was dealt with by Prof. Fr. Jacobsen (Norway) in an interesting manner; he indicated the economical results of voltage variation from the consumers' point of view, and contended that pressure could be maintained at a uniform level inexpensively and without complication. A representative of the author outlined the scope of M. J. Tribot Laspière's paper on high- and extra-high-pressure transmission lines in France, mentioning the leading features of those in use and others in course of erection, and remarking that a tidal power electricity generating station was to be taken in hand shortly. A delegate from South Sweden, who spoke of the interconnection of hydro-electric systems in its relation to storage economy, emphasised the fact that it was not generally realised that the losses in water storage might be as great as, or greater than, those in accumulators.

An American delegate announced that in California there was an interconnected system of 1½ million horse power, both water power and steam stations, and some 5 million acres of farms were completely electrified. There was a large demand for power for water pumping, and their aim was to distribute the pumping load over the 24 hours, while allowing the actual manual work of irrigation to be done in an 8-hour day. Oil was used there extensively for lighting purposes, and in order to compete with it at a price of one dollar per gallon, electricity must sell at 3 cents per kWh. Ing. Guido Semenza (Italy) pointed out that his country possessed no iron, copper, or coal; they had been forced therefore to study such substances very carefully in order that they should be used economically. For that reason also metallic transmission-line poles had been used very early in Italy because they had a longer life than wood poles. The importation of power was a problem in Southern Italy; the island of Sicily had water power, but the current and width (four miles) of the Straits of Messina made it very difficult to lay cables. A tunnel had been proposed to accommodate both electric cables and a railway, but it would have to be built in the earthquake zone; the solution would probably be an overhead crossing.

An English delegate thought that the discussion might help rural distribution in this country. That would have to start by tapping a h.p. line, and it must be done cheaply and securely. He suggested the use of a ring main divided at fairly frequent intervals by circuit breakers, from each side of which tappings could be taken for a transformer through a change-over switch, so that should any ring-main circuit breaker function, the transformer could regain a supply from the other side of it. What number of voltages to adopt was a question that needed to be settled. There was a tendency to use too many pressures, and he advocated the adoption of a 2-voltage system in this country, even if it was not the most economical one at the moment. That would eliminate the intermediate pressure; there was a tendency for h.p. apparatus to become cheaper, and this country had already suffered from the use of too many voltages. People who changed their dwelling place did not want to bother about what voltage they would have to use in the new house; standardisation of pressure for rural distribution was very desirable.

List of Papers.

(*Continued from page* 91.)

SECTION G1

208. Les Lignes francaises de transmission d'énergie électrique à hautes et très hautes tensions: J. Tribot Laspière (France).
211. Short-circuit Currents in Large Power Stations: Prof. Dr. Reinhold Rüdenburg (Germany).
212. Distribution of Electrical Energy in Germany, with Special Reference to the Bayernwerk: Dipl. Ing. A. Menge (Germany).
214. The Transmission and Distribution of Electrical Energy: Charles H. Merz (Great Britain).
215. High-tension Cables: Llewelyn B. Atkinson, M.I.E.E., A.M.Inst.C.E. (Great Britain).
216. Loading Limits for Electric Power Cables—Some Recent Researches: E. Fawssett, S. W. Melsom, C. Vernier, and E. B. Wedmore (Great Britain).
217. The Improvement of Power Factor: Prof. Miles Walker, D.Sc. (Great Britain).
218. Large Alternators: A. B. Field, M.A., B.Sc. (Great Britain).
220. Apercu sur la production et la distribution de l'énergie électrique dans l'union des Soviet-Républiques socialistes: Conseil Electrotechnique Central (Russia).
221. Some Notes on the Stability of Power Stations working in Parallel: G. J. T. Bakker and J. C. Van Staveren (Holland).
222. Application of Squirrel-Cage Induction Motors with Special Starting Characteristics: Ir. A. Brunt (Holland).
223. Ironclad Switchgear: H. A. Hidde Nijland (Holland).
224. Recent Development in Power Station Design in the Netherlands: J. J. L. Smits (Holland).
225. The Electrification of Holland: F. A. Smit Kleine and High-Tension Committee (Holland).
226. Recent Electrical Developments in Overhead Electric Transmission in Italy: Ing. U. Del. Buono (Italy).
227. Recent Mechanical Developments in Overhead Transmission Lines: Gino Rebora (Italy).
228. The Development of, and the Limits in Parallel Operation and Interconnection of Large Electrical Systems: Renzo Norsa (Italy).
229. Electric Cables for Extra High Tensions: Ing. Luigi Emanueli (Italy).
230. The Continuity and Regularity of Operation of Large Electric Systems: Ing. Guido Semenza (Italy).
231. Determination of Efficiency and Phase Displacement in Transformers by Measurement on Open-circuit and Short-circuit Tests: O. S. Brügstad (Norway).
232. The Influence of Voltage Regulation on Electricity as a Product of Quality: Prof. Fr. Jacobsen (Norway).
233. Network of National High-tension Lines: Luis Sanchez Cuervo (Spain).
234. Description of the System of Generating, Transmitting, and Distributing Electricity in Catalonia: Catalana de Gas y Electricidad S.A. (Spain).
235. Considerations affecting the Interconnection of Existing Transmission Systems: Claudius E. Bennett (Spain).
236. Recent Developments in a.c. Generator and Motor Design: R. Liljeblad (Sweden).
237. Recent Practice in Transformer Design: K. E. Eriksson (Sweden).
238. Economic and Technical Organisation of Large-scale Power Distribution in Sweden: W. Borgquist (Sweden).
239. Technical and Administrative Systems for Rural Electrification in Sweden: Nils Ekwall, C.I. (Sweden).
240. Design and Standardisation of Transformers: Dr. Ing. Arle Ytterberg (Sweden).
241. Modern a.c. Switchgear in Sweden: K. E. Eriksson (Sweden).
242. Low-tension Distribution and Electric Storage: Carl A. Rosander (Sweden).
243. Description abrégée des usines centrales électriques de l'etat en construction: Ing. S. Tolkatscheff (Russia).
244. American Power Station Electrical Equipment: B. G. Lamme, M.A.I.E.E. (U.S.A.).
245. The Technical Problems of High-tension Electric Power Transmission: F. G. Baum (U.S.A.).
246. Superpower: W. S. Murray (U.S.A.).
247. Modern Steam Power Stations for Generating Electrical Energy: Dr. Klingenberg (Germany).
248. Export of Electrical Power from Norway: S. Kloumann (Norway).
249. The Frequency Converter: Prof. Dr. Paul Müller (Germany).
250. Hungarian Practice in High-speed Turbo-Alternator Design: E. Wilczek (Hungary).
251. The Employment of Large Water-power Plants: Styrian Water Power and Electricity Co. (Austria).

SECTION G2

219. High Voltage, Direct Current Generation and Distribution of Electrical Energy: J. S. Highfield and W. E. Highfield (Great Britain).

SECTION H

POWER IN INDUSTRY.

261. The Utilisation of the Power Resources of Austria with Special Reference to the Consumption of Electric Power: Eugen Karel (Austria).
262. Utilisation of Power in Canada: P. T. Davies (Canada).
263. Technical Development and Financial Organisation, including Co-operative Schemes for Electricity Supply in Agriculture in Denmark: F. H. Krebs, B.Sc. (Eng.) (Denmark).
264. Design of Low-tension lines and Installations for Rural Electrification: B. Faaborg Andersen (Denmark).
265. Some Notes on the Future of Electrical Supply and Demand: Sir Alexander B. W. Kennedy (Great Britain).
266. Electro-Farming Economics: R. Borlase Matthews (Great Britain).

(*To be continued.*)

How Advertising can Help the Retail Electrical Trade.

By ERIC N. SIMONS.

THE function of advertising as applied to the retail electrical trade is to move goods from the retailer's stock into the possession of the potential consumer. The complexities of this apparently simple problem are not reduced by the fact that the electrical trade is highly specialised. But, fundamentally, the psychology of human beings is the same whatever the objects that advertising aims to introduce to them, and since advertising itself is in principle based upon the psychology of human beings, the broad outlines of its application to the problems of individual trades must remain the same, however much those trades may differ in themselves.

How, then, can advertising begin to sell electrical goods? It can begin, in the first place, by making those goods known. Let it be understood that in this article the writer deals specifically with trade-journal and newspaper advertising, and not with those less definite forms of advertisement such as shop-window display, circularising, and so forth. A corporation electricity supply department can afford to have a handsome showroom in the principal street of a city, and often does, though its main object is to sell current and not appliances. Small retailers have to be content with what room they have in their windows. And in many cases these displays are the sole means used of drawing public attention to the goods offered.

Advertising is a valuable adjunct that the retailer cannot afford to ignore. But its practical application is what concerns us here. How is it to be carried out? The retailer may not be capitalised to such an extent that he can afford a heavy outlay on advertisement space in the local journals. In such instances it is often possible for a number of retailers serving a particular district to advertise electrical goods co-operatively, the aim being not so much to draw attention to a particular shop as to the general advantage and utility of electrical appliances. Before these details are discussed, however, it will be better to show as clearly as possible why advertising is necessary.

In the first place, the public at large is extraordinarily ignorant of the possibilities and performance of many electrical contrivances.

In ordinary retailing, a customer either knows what he wants before he enters the shop, or sees what he wants inside it, and decides to buy. In retailing electrical goods, he has generally to be told what he wants. His problems have to be analysed and recommendations made. It follows, therefore, that whatever Press advertising is done by retailers of electrical goods must take this fact into account.

What is needed is an educational advertising campaign, whether carried out by individual retailers or by co-operation. People do not know enough about electrical appliances. The manufacturers advertise to the retail trade, and to technical men, far more than they do to the man in the street. It is this that holds back the development of electricity. One has only to listen to a retail shop assistant or salesman trying to sell an electric iron to a local housewife to realise how ignorant women still are of the advantages of electricity. All sorts of absurd notions abound, such as (in the case mentioned) that the contrivance is likely to explode; is terribly dear; will burn the clothes unless worked by an expert; reduces the strength of the lighting; and so forth.

The retailer in his advertisements should take local conditions, voltage, &c., and show in detail the savings that can be effected by the use of electrical appliances. He will have, of course, to give typical instances, and this may demand some little research on his part, but the problem is not insoluble, and the reward will be great. Furthermore, he should stress the potential economies, the less tangible but equally important savings in time, labour, and so forth. Quite a useful series of advertisements could be drawn up by him as a result of his experience in selling. The objections most frequently raised from time to time by customers are often typical of those nursed by the public at large, and could be dealt with and countered in his announcements in the papers. An analysis will show that two things above all weigh with possible users of electrical goods. These are: a suspicion that technical skill is required in their management, and first costs (which include cost of installation, where this is necessary). These, then, are the two specific objections on which the retailer's advertising should concentrate. It is not sufficient to show illustrations of electrical goods and to state simply that they can be bought at a particular address. This is not good advertising, nor is it good salesmanship. The retailer must aim to attract the attention of the prospective purchaser, first, by employing the right papers to reach the locality and customers he needs; and secondly, by giving his announcement the dignity and effectiveness of good typographical display. Next he must arouse interest, which can be done chiefly by writing good "copy" or text on the lines indicated, and capping it with a striking headline. The headlines of one retailer of electrical goods who advertised in an evening paper could not be missed. Here are a few of them:—

"She Dismissed Two Servants"; "The Iron did not Explode"; "Who Wants an Extra Day's Leisure?"; "A Pleasant Electric Shock"; "The Water was Cold, but he got a Hot Bath."

Having attracted attention and aroused interest, the next task of the advertisement is to stimulate or create desire. In other words, every conceivable advantage that electrical goods possess must be forcibly presented, in the order of their importance. Effective writing tells here, and if the retailer does not feel himself competent to supervise his own advertising, he will find it better to employ a trained advertising man, taking care, however, to see that he does not fall into the hands of a quack.

Finally, and here comes the crux, the advertisement is not complete unless it induces action. In one way or another the customer must be made to take at least one active step towards acquiring the goods. There are several ways of doing this, depending chiefly upon the kind of action most likely to lead to purchase. In general, the retailer will find it best to tempt the reader of his advertisements to visit his showrooms. Once there, his salesmen will have an opportunity to learn the customer's problems at first hand, and to explode any false notions that may be entertained. The announcement can either close with a brief statement that the goods described in it are to be seen at such and such an address; or a cordial invitation to visit the showrooms can be worked in. But these are mere last-minute expedients, too usual to awaken any keen desire on the customer's part to call. The invitation must be more subtly conveyed. Much will, of course, depend upon the size of space taken, but even a few words can be amazingly effective and original. Here is how one local retailer worded this part of his advertisement:—

"Free lessons in dodging housework given at ——."

Sometimes, as a variation upon this theme, it may be advisable to get the customer to write for a descriptive booklet or catalogue setting out at length the economies that can be effected by use of a particular appliance.

The manufacturer often supplies, or is willing to supply, literature of this kind for free distribution by the retailer, and this fact should be borne in mind. Similarly, many manufacturers are willing to lend electros for advertising purposes, and to give help in the formulation of advertising schemes.

From time to time special emergencies may necessitate a departure from the strictly educational form of advertising which the retailer is recommended here to adopt. The introduction of a new appliance, the improvement of an old one, a special demonstration week, a sale, may all rightly claim special advertisement. But one point needs particular emphasis. Whatever the purpose of the advertisement, whatever its subject, it must above all things be honest. It pays to tell the truth in advertisements, both materially and morally. Extravagant claims do not help the sale of electrical goods; they only hinder it. Another necessary injunction is that the retailer should be specific in his statements. It is not sufficient to declare dogmatically: "Electric fires are cheaper than coal fires," or that "Brown is the man to see for electrical appliances." The advertisement must say *how much* or *in what way* electric fires are cheaper than coal fires, giving facts and figures wherever possible; it must say *why* Brown is the man, giving facts about Brown and his business methods, his stock, and so forth.

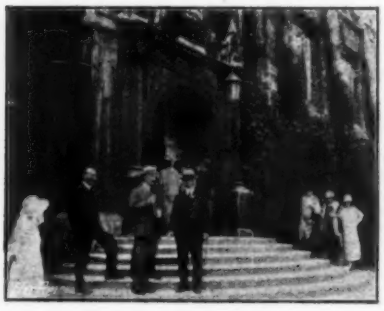
It must not be too rashly assumed that women are the chief purchasers of electrical goods, especially those of a domestic character. They are often conservative in their methods, and apt to distrust the novelty in the home. In more than one instance known to the writer it has been the influence of the male members of a household that has led to the adoption of electrical devices. This is a point that the retailer should remember, not only when designing his advertisements, but also when deciding in which papers, &c., those advertisements shall appear.

The Institution of Electrical Engineers.

Visit of Oversea Electrical Engineers.

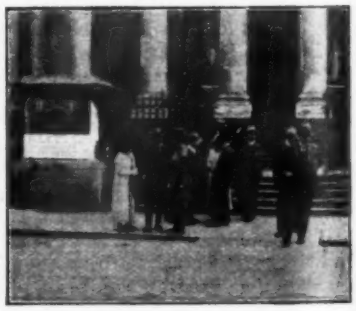
(*Concluded from p.* 119.)

On Tuesday, July 15th, the visitors proceeded to the overhaul works of the London General Omnibus Co., Ltd., at Chiswick, and inspected the various departments of this establishment, after which they were received by Field-Marshal Sir William Robertson, in the unavoidable absence of Lord Ashfield. An excellent luncheon was served at the works, over which Sir William presided, and in a brief speech he offered a cordial welcome to the party, expressing the view that such

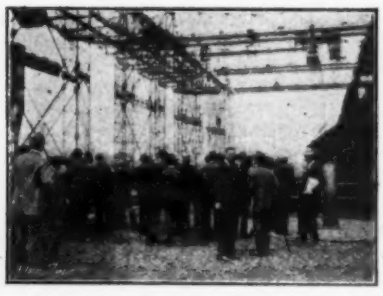


The Entrance of the Hall of Trinity College.

A Group of Visitors off Sightseeing.



Leaving the Fitzwilliam Museum.



The Visitors at Nechells Power Station.

At Anne Hathaway's Cottage.

The House that Shakespeare lived in.

At the Chapel, Windsor Castle.

The Party leaving the Castle.

At the Overhaul Works, Chiswick.

visits, affording opportunities for the exchange of ideas between people of different nationalities, were of the greatest value. Not only did they promote the advancement of science and trade, they might do much to prevent the recurrence of such a tragedy as the Great War. Senor C. E. Montanes, president of the National Association of Industrial Engineers of Spain, responded in a short and happily worded speech.

The party then set out in motor coaches for Windsor, travelling *via* the new Great West Road and the Bath Road through Slough and Eton. On their arrival at Windsor Castle, the visitors were received by Dr. Lionel Cust, M.V.O., and Mr. Miles, who conducted them through the State Apartments, including by special permission of the King a number of rooms to which the public are not usually admitted. Afterwards tea was served at the White Hart Hotel, before the party returned to London, passing through Old Windsor, Runnimede, Egham, Staines, and Kew.

In the evening the programme was concluded by a conversazione at the Institution of Civil Engineers, organised by the Institutions of Civil, Mechanical, and Electrical Engineers.

We give herewith a few reproductions of snapshots taken during the visits to Cambridge, Stratford, and Windsor. The weather on each occasion was all that could be desired, and the visitors thoroughly enjoyed the functions and excursions in which they took part.

Parliamentary.

(By Our Special Parliamentary Reporter.)

Royal Assent.—The Royal Assent has been given to the West Indian Islands (Telegraph) Bill, the Pacific Cable Bill, the City of London (Various Powers) Bill, the London County Council (Tramways and Improvements) Bill, and the Central London and Metropolitan District Railways Companies Bill.

Private Bills.—On July 15th, in the House of Lords, the London County Council (Money) Bill was read a second time. The London, Midland and Scottish Railway Bill, the London and North-Eastern Railway Bill, and the Grampian Electricity Supply Bill, were read a third time.

Broadcasting Licence Fees.—On July 15th, Mr. HARTSHORN, in reply to Mr. BAKER, who asked whether he was aware that the amount paid to the British Broadcasting Company on account of licence fees up to March 31st, 1924, was £105,483; whether the anticipated revenue for licence fees for the year ending March, 1925, was £400,000; and whether he would carefully consider the desirability of reducing the cost of the licences or alter the proportion payable to the British Broadcasting Company, said that the total amount payable to the company in respect of licences issued up to March 31st, 1924, was about £432,000, but payment was made by monthly instalments in arrear, and the amount actually paid by March 31st last was £71,450. The amount payable to the company in respect of licences issued during the twelve months ending March 31st, 1925, was expected to be about £400,000. The fee for constructors' licences—which formed the bulk of the licences hitherto issued—was reduced from 15s. to 10s. on July 1st, with the consequence that the company's share was reduced from 12s. 6d. to 7s. 6d. The considerations mentioned in the last part of the question would not be lost sight of, but at the present stage it would be premature to assume that the revenue of the company would be more than was necessary to provide an efficient broadcasting service.

Toll Telephone System.—On July 15th, Mr. HARTSHORN informed Sir H. BRITTAIN that the capacity of the present Toll Exchange would not admit of any addition to the number of exchanges included within the Toll area; but it was in contemplation to provide a new Toll Exchange, and the area at present served by the system would then be considerably enlarged so as to include many additional places within fifty or sixty miles of London.

Transatlantic Radio Telephony.—On July 15th, in reply to Mr. D. G. SOMERVILLE, who asked if he could state the results of the radio telephony experiments which had been carried out recently with America, the Postmaster-General (Mr. HARTSHORN) said that the results of the experiments at present available were encouraging.

Railway Electrification.—On July 15th, Mr. KIRKWOOD asked the Minister of Transport, if, in view of the present condition of the underground railway system in and around Glasgow, he could bring any pressure on the railway companies concerned to have these systems electrified so as to bring them up to modern requirements, and thus provide useful work for thousands of unemployed skilled and unskilled workers.

Mr. GOSLING said that he had brought this matter to the notice of the railway companies concerned and he was informed by the London, Midland and Scottish Railway Company that the question of the electrification of the Glasgow underground railway systems had received consideration, but that there was no prospect of securing such additional traffic at present as would justify the large expenditure involved. The company added that the matter would, however, be kept under notice and reviewed from time to time in the light of changing circumstances.

Rent for Radio Aerials.—On July 16th, Mr. F. HALL, replying for Mr. HARTSHORN, informed Mr. LINFIELD that he understood that many landlords required a small payment by their tenants for permission to erect wireless aerials. The matter was primarily one for settlement between landlord and tenant, and the Postmaster-General had at present no power to intervene. The Broadcasting Committee of last year expressed the view that the practice was unjustifiable and should be abandoned. In this the Postmaster-General concurred, and he was considering what steps could be taken to prevent the spread of the practice.

A Special Order.—On July 16th, Mr. BROWN asked the Minister of Transport if an application had been made under the Electricity Supply Acts, 1882 to 1922, for a special Electricity Order in respect of the parish of Wasperton and other parishes in the rural districts of Warwick, Brailes, Stratford-on-Avon, and Southam, and, if so, if he would say what action had been taken upon this application.

Mr. GOSLING said that the application referred to was made to the Commissioners on June 30th, 1924. A decision had not been arrived at by the Commissioners, as the time prescribed by the public notices for the lodging of objections would not expire until July 31st.

The Apprenticeship System.—On July 16th, Lieutenant-Commander FLETCHER asked the Minister of Labour if he was aware that the apprenticeship system was becoming almost extinct; and if he was willing to take any steps in order to revive it, in view of the fact that many lads between 14 and 18 who had never been taught any skilled trade were at present drawing unemployment benefit.

Mr. SHAW said he was aware that changes in the organisation of methods of production in conjunction with industrial depression had tended of late years to reduce the extent to which apprenticeship prevailed, but he was not in a position to say whether this tendency would continue to operate. He was, however, as opportunity offered, encouraging the appropriate industrial organisations to consider the subject. Even in the most favourable circumstances only a comparatively small proportion of youths could become apprentices. Boys under 16 could not draw unemployment benefit.

Ex-Service Trainees.—On July 16th, Mr. SHAW informed Captain BOWYER that at the end of June there were 5,279 ex-Service men receiving training in Government Instructional Factories and other training centres. In addition, there were 3,335 receiving training in employers' workshops. 3,567 were awaiting training, of whom 2,141 were resident in Ireland. Of those awaiting training 844 were temporarily unfit for training and 230 others were being considered for civil liability grants in lieu of training. 3,205 men who had completed the institutional part of their training were awaiting improvership.

The Severn Barrage Scheme.—On July 16th, Viscount CURZON asked the Minister of Labour whether, in view of the collapse of the Severn barrage scheme and the decision of the Government not to proceed with the Channel Tunnel, he could indicate exactly what solution the Government had in mind for the unemployment problem.

Mr. SHAW said there was no ground for the statement that the Severn barrage scheme had collapsed; on the contrary, the initial steps necessary for determining whether it was likely to be a practicable scheme were progressing satisfactorily. The further plans of the Government for the relief of unemployment could not be dealt with by way of question and answer, but an opportunity for discussing them would, no doubt, arise before the Recess.

Smoke Abatement Bill.—On July 16th, this Bill, which follows on the lines of that introduced last year, was read a second time in the House of Lords.

Hastings Corporation Bill.—This Bill came before Section B of the Local Legislation Committee of the House of Commons last week. One section of the Bill related to the electricity undertaking and clauses of the usual form were passed. Two new clauses were, however, opposed by the Hastings and St. Leonard's Gas Co. The first provided that all moneys paid and received in respect of the undertaking should be disbursed from or paid into the Borough Fund, and the other provided for the formation of a reserve fund by the setting aside each year of an amount not exceeding one-half per cent. of the aggregate capital expenditure, the total amount of the fund not to exceed 10 per cent. of this expenditure. The Gas Co. said that the first clause would remove the necessity for paying back moneys which had been taken from the rates to meet past deficiencies. Mr. Rowand Harker, for the Corporation, pointed out that the clauses were similar to those inserted in the Torquay Corporation Bill last year. The second, however, differed from the Torquay clause as the reserve fund could only be built up from the surplus profits of the undertaking. Counsel handed in a table showing that the result since 1898 was a deficit of £4,518. The net amount taken from the rates was £31,092.

In its petition the Gas Co. stated that municipal utility enterprises should be self-supporting, and asked for the insertion of a clause limiting the amount which might be taken from the rates and the amendment of the two clauses to make them consistent with the general Electricity Supply Acts. A reference was made to the extensions which the Corporation had projected, and which would constitute a further burden on the rates.

Mr. HARKER said that although a deficit would be incurred during the change-over to the proposed new station, thereafter conditions would be improved.

Mr. ARTHUR COLLINS said that had it not been for the war the undertaking would have been a constant source of profit since 1912. The Gas Co.'s contribution to the deficiency which had been taken from the rates averaged £6 per year over the whole period.

Sir HARRY COURTHOPE MUNROE, K.C., for the Company, said that the Corporation, instead of refunding money taken from the rates, intended to create a reserve fund. If the Committee allowed the clause, he asked for a further clause providing that if the charges for electricity were insufficient to meet the cost of working they should be increased.

The Committee decided that the clauses objected to should remain.

L.C.C. (Lambeth Bridge) Bill.—This Bill was considered by a Committee of the House of Commons last week. The purpose of the Bill is to empower the London County Council to construct a new bridge across the Thames at Lambeth, to replace the existing bridge, which has been closed against traffic for some years.

Amongst the petitioners against the Bill was the London Electric Supply Corporation, Ltd., with regard to the question of a wayleave across the bridge for electric mains. There was a certain amount of discussion as to the amount to be paid by the company for the facilities afforded for carrying mains across the bridge, and finally a clause was agreed between the parties. This provided that, in constructing the bridge, the Council should make provision, in such part or parts as it should determine, for the electric lines and main transmission lines of the company, by a conduit of a section of not less than 6 ft. by 1 ft. 6 in., or two conduits of not less than 3 ft. by 1 ft. 6 in. each. The company would be entitled to lay, in accordance with the reasonable directions of the Council, electric lines and main transmission lines in the positions in which provision was made for them, and to maintain, renew and inspect them subject to such directions. The amount to be paid to the Council was to be settled by agreement, or, in case of difference, by arbitration, under the provisions of the Arbitration Act, 1889.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Magnet" Mine Signalling Key.

A new pattern of mine signalling key has been recently introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. This key, which is illustrated in fig. 1, marks a decided advance upon the previous patterns and has been specially designed to comply in all respects with the requirements of the Home Office. The electrical mechanism is contained in a substantial cast-iron case with malleable iron cover, and consists of a spindle carrying a forked flat spring. This is kept in the closed position with the upper contact ready for receiving incoming signals by the pressure of two spiral springs, and outgoing signals are given by a grip lever which

Fig. 1.—The "Magnet" Mine Signalling Key.

rotates the spindle and causes the flat spring to close with the lower contact. The grip lever is entirely protected by a robust guard of malleable iron and is therefore not only protected against breakage by a fall of *débris* or accidental blows, but accidental signals due to men carelessly leaning against the key, or throwing stones are rendered impossible. This key has a further advantage over the knob pattern in that it is far easier to manipulate, and quicker signalling can be carried out.

The "Zenith" Electric Clock.

A clock whose action depends upon the expansion of an electric wire due to the passage of an electric current and its contraction, and which is arranged to operate from lighting supply wires, has been designed by the ZENITH WATCH MANUFACTURING CO., Le Locle, Switzerland. A view of the mechanism appears in fig. 2, which represents the front of the clock with the dial removed. The current is taken through the transformer seen in the top right-hand corner, or, if the supply is direct current through a suitable resistance, to reduce the pressure to about 3 V. The expanding and contracting wire is contained in the tube seen on the left-hand side of the illustration. At the bottom it is secured to a terminal block whence the return lead proceeds to the transformer. The top end of the wire is attached to a pivoted yoke. Any movement of this yoke is communicated by way of a spring wire and a connecting cord to the pendulum

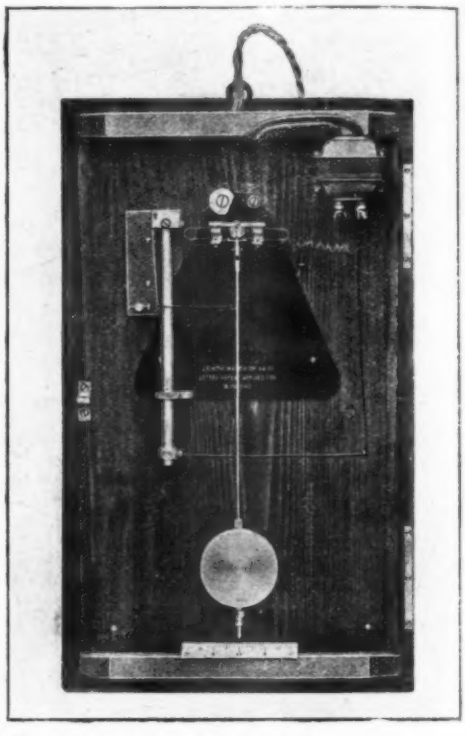


Fig. 2.—The "Zenith" Electric Clock.

By a suitable arrangement of contacts on the pendulum suspension the current is switched on and off by the pendulum's motion. The clock is set going by allowing the bob to fall from its left-hand limit. In its swing it closes certain contacts, which allows the whole of the current to pass through the wire, which expands and allows the pendulum freedom to swing over to the right. At the end of the swing the contacts are opened and the wire rapidly cools, drawing the pendulum back to the left, and the cycle is repeated. The contact mechanism can easily be adapted to the working of subsidiary clocks or "slave dials." If desired, the clock can be fitted with a clockwork attachment which is maintained by the pendulum in a "wound-up" state so that should the current be interrupted the clock is kept in action by this "power reserve," which can operate for 30 hours.

A Thermostat for Hot-water Tanks.

Mr. GEO. WILKINSON, of Beech Mount, Harrogate, has devised a thermostat for water heaters based upon the "Losles" thermostat described in the ELECTRICAL REVIEW of December 21st, 1923. The new design is arranged to screw horizontally into a flange on the heater; a tube projecting into the water space contains a volatile fluid, which boils when the water reaches a certain temperature, causing a flexible diaphragm to swell, and to actuate a mercury-in-glass circuit-breaker as in the former design. Provision is made for adjusting the temperature setting by means of a milled nut. The operation of the thermostat ensures that energy is not wasted, and that the temperature of the water never rises too high, manual control being unnecessary.

The E.T.U.—The *Daily Herald* states that, after several ballots, Mr. M. T. Greenwall has been elected to the position of assistant secretary of the Electrical Trades Union, in succession to Mr. Citrine, who is now assistant secretary to the General Council of the Trade Union Congress.

Electricity in Factories and Workshops.

H.M. Chief Inspector's Report.

THE annual report of H.M. Chief Inspector of Factories and workshops for the year 1923 has recently been issued.* The chapter devoted to the report of the senior electrical inspector, Mr. G. Scott Ram, M.I.E.E., points out that the use of electrical energy on factory premises for motive power, lighting, and other special purposes continues to extend rapidly and, as a consequence, seldom does one find a generating station in an industrial area that is not undergoing extension. Several large new stations have been completed during the year and they are generally well designed. Unfortunately, even amongst the larger undertakings, there are examples to the contrary, where through the most unaccountable oversight or indifference, quite elementary provisions for safety are neglected. Thus in one new station the switchroom could be truthfully described as a death trap. All the defects were admitted on being pointed out, and it is difficult to surmise how they could have been allowed to arise. In another case the supply undertaking had relied on a consulting engineer, and a high-pressure switchboard was erected in a manner contravening practically all regulations; a new switchboard is now on order. On large systems the effects of an explosion of an oil switch may be very severe. In one case recently the sub-station walls were blown out and the station was demolished.

Several outdoor sub-stations have been put to work during the year. In some the apparatus is wholly out of doors, and in others the switchgear is housed in a building. It appears doubtful whether the saving in the cost of buildings will compensate for the increased cost of making the apparatus weatherproof and of maintaining it.

The divisional electrical inspectors have done valuable work in their respective areas. Mr. Swann (southern area), dealing with factory installations, states that the larger supply authorities might at least be expected to know something about the requirements of the regulations, but in an area developed during this year by one company, he found that, acting as contractor, it had installed a.c. plant in many ways contrary to the requirements. At a well-known electrical manufacturing works he found practically nothing right from the point of the main supply up to the motors or lamps. In machine rooms the provision of means at hand to stop the motors is sometimes overlooked, and there is no point about the average factory installation which receives such scant and unworkmanlike attention as the provision of proper and mechanically robust earthing bonds. There is seldom a definite scheme of earthing, and omission of earthing is frequent in connection with portable apparatus. Testing in electrical manufacturing works is often unnecessarily dangerous, while in the manufacture of lamps and thermionic valves, in some cases a high standard of safeguards has been adopted, but in others quite the reverse.

Mr. McColgan (northern area), in discussing switchgear, states:—In many instances the vent pipe arrangement is dangerous. In one accident the oil vent discharge was immediately below the bare e.h.p. conductors. The gas discharge was ignited and the arc spread with it across the phases and the flame passed through the expanded metal screen, severely burning the attendant at the operating handle 4 ft. away. The safest arrangement is to have the vent pipes to discharge outside the building, using pipes as straight as possible.

Mr. Brown (Midland area) reports:—A great many works electricians who have previously had experience only of d.c. do not realise the extra danger encountered on a.c. installations. The quality of the work found on factory premises may be said to be improving, but much of it is yet far from satisfactory. Some of the faults are due to the manufacturers of the plant.

Mr. Tackley (western area) reports on the technical aspect of large supply undertakings in his area and he describes various new processes in electric welding and furnaces. He also refers to the increasing substitution in factories of alternating for direct current and to the fact that additional risks are often overlooked by persons responsible, even by some chief engineers of supply undertakings. Whereas power plant is generally treated with respect, no discrimination is made between alternating and direct-current lighting installations. Installations put in under the direction of consulting engineers have been found to be contrary to the regulations in many respects; the consultants excused themselves by saying they were not aware that any regulations existed.

The number of accidents due to electricity reported during the year was 361, including 21 fatal cases, compared with 309 and 17 fatal cases in 1922. Three "dangerous occurrences" were also reported. Whilst the total number of accidents has, therefore, increased by 17 per cent. over that of the previous year, it is very considerably less than it was ten years ago. The accident rate per amount of energy used or per number of factories using electrical energy, has fallen very greatly.

Forty of the accidents, including nine fatal cases, occurred on high-pressure or extra-high-pressure systems. Of these, 23 (six fatal) occurred in electrical stations of public supply authorities. In one case, the cable was covered with its original paper insulation, further served with tape, and in the other the conductor was heavily taped up. Mr. Ram has drawn attention in several previous reports to the danger of relying on such methods of protection. Although the insulating tape may be of good high-pressure quality and will withstand puncture tests in the laboratory at much higher pressures than it is subsequently used for, and although a number of layers may be applied to the conductor, the accident records show that it cannot be relied upon in practice. Further guarding should always be provided in positions where it is liable to be touched.

As usual, the larger number of fatal accidents occurred on a.c. systems of low or medium pressure. There were ten where the pressure of the shock to earth was from 210 volts to 250 volts. Six of them were on lighting circuits, five being due to non-earthing of the lampholders or fittings. In the case of run-ways, the firms erecting them frequently overlook the necessity to provide protection at places where persons are liable to come into contact with the conductors. One fatality occurred in the use of direct current at 220 volts and, as usual in d.c. cases, the circumstances were particularly favourable to a severe shock being received. The man was repairing the inside of a Lancashire boiler by arc welding. Instead of using a motor-generator, or petrol-electric set giving, say, 60 volts, the works current at 220 volts was utilised, the pressure being "broken down" by resistances. The open-circuit pressure was therefore 220 volts and it is presumed that the man received this pressure in the course of changing the electrode whilst in an extremely awkward and cramped position between the boiler flue and the feed distribution pipe.

Two of the "dangerous occurrences" reported involved the complete wrecking of turbo-generators, one being a 3,000-kW, and the other a 6,000-kW set. In each case, although several persons were in the vicinity at the time, no one was injured.

In 13 cases of electric shock it is definitely recorded that the victims were rendered unconscious and were brought round by artificial respiration; the cases included shock from both direct and alternating current and over a wide range of pressure. In 12 of the cases the victims were brought round in half an hour or less, but in one case (250 volts a.c.) after two hours. This again proves the value of long-continued treatment. In one case (3,000 volts a.c.) the patient became very violent after recovery; in another (6,600 volts a.c.) there were two periods of unconsciousness; while a case of d.c. shock at 100,000 volts needed 30 minutes.

In the case of the fatal accidents, other than those where the victims died subsequently from burns, artificial respiration was carried on in one case for two hours, in five for over an hour, in six for half an hour or more; one for twenty minutes, one for two minutes and in one case, in a public supply generating station, it was not attempted at all.

The chief inspector, Mr. G. Bellhouse, remarks that in the Midlands there was great activity in the manufacture of radio apparatus in 1923.

With trade in such an unsettled condition, new developments were less numerous than usual. Perhaps the most striking were the development of large electrical power stations, and the all-round increase in demand for electrical energy for power, lighting, and other purposes

Other interesting new developments were the manufacture of synthetic ammonia nitrates, an electrolytic process for the manufacture of carbonate of lead, and the use of stainless steel in connection with turbines.

The unfortunate effect of sustained depression in industry on the employment of young persons is mentioned. Employers appear reluctant to employ young workers who require training when adults are so easily obtainable; such a position is very unsatisfactory, as many young people are receiving no industrial training whatever. The number of registered factories in Great Britain has again increased. The total now stands at 139,920 as against 137,858 for 1922. Workshops declined from 145,684 to 140,850, while during the year a total of 125,551 accidents (including 867 fatal) were reported, an increase of 27,565 over the previous year.

The growth of the "Safety First" movement is not altogether encouraging, although there are conspicuous examples to the contrary. The following figures demonstrate its success when it is properly organised. The first example gives the latest figures for the paper mills in the London area:—

Year.	No. of Accidents Causing at least 1 day's Absence.	Fatal Accidents.	Permanent Disablement.	Frequency Rate. No. of Accidents per 1,000,000 hours worked.	Severity Rate. No. of Days Lost per 1,000 Workers.
1920 ...	94	Nil.	10	32.27	1.44
1921 ...	48	1	2	28.59	.73
1922 ...	52	Nil.	Nil.	25.89	.88
1923 ...	49	Nil.	Nil.	23.61	.83

* H.M. Stationery Office, price 3s. net. (Cmd. 2,165.)

The following figures apply to a works in Liverpool in which over 2,000 persons are employed:—

Year.	Percentage of accidents to persons employed.
1917-1918	9.4
1920-1921	6.4
1922-1923	4.0

The next example, coming from a large engineering firm in the Midlands, shows the decline in the cost of compensation for £100 wages:—

	s. d.
1913	9 11¼
1916	4 5¼
1919	3 4
1923	2 8

Inspectors continue to refer to the gradual replacement of small steam engines by oil or gas engines and electric motors. This transformation is most marked as regards the adoption of the oil engine in rural areas and incidentally is all to the good, for the safety of boilers has always been a matter of greater difficulty in outlying districts than in industrial centres.

It is clear that much more attention is being given by employers to adequate and suitable lighting in a wide range of industries, and it is evident that the standard is steadily rising.

In engineering shops the system of providing separate lights for each machine tool is developing. Individual power presses have been observed with small electric lights which throw a clear light on the space between the tool and the die. The light comes usually from the side of the press behind the tool, and is so arranged that glare is avoided. Marked improvement has been noted in the lighting of rooms in which the delicacy of the work necessitates the close application of the eyes. A good many instances of glare, due to improperly arranged or defectively shaded electric lights, have been discovered, but these are gradually being rectified.

The excessive incidence of lead poisoning in the manufacture of electric accumulators—95 cases (two fatal) against 32 (none fatal) in 1922—mainly in two works, in one of which 54 cases occurred and in the other 15) was due to a large impetus in the trade, owing to the advent of broadcasting and to the extended use of electric lighting on motor cars. Other contributory causes were high pressure of work, overtime, the engagement of many new unskilled workers, and the close proximity of persons, all of which tended to the creation of dangerous dust, much of it outside the scope of existing ventilation. There was also indifferent supervision in carrying out the spirit of the regulations. The report by Dr. Bridge and Mr. Price, with recommendations for revision of the Code of Regulations—the first made under the 1901 Act—has been issued to the industry and steps are now being taken to give effect to their recommendations.

The Hydro-Electric Power Commission of Ontario.

Sixteenth Annual Report.

THE May *Bulletin* of the Hydro-Electric Power Commission of Ontario contains a preliminary survey of the operations of the Commission and its municipal distributing agents during the year 1923. The report contains detailed balance sheets for 235 municipalities and operating reports for 224, an increase for the year of nine and ten respectively. The consolidated balance sheet for all municipalities shows a percentage of net debt to total assets of 64.9 per cent., as against 88 per cent. in 1913. No other figures could show in a more gratifying manner the solid financial foundation on which the organisation stands. The Commission's operating reports are most gratifying. On the Niagara system the actual cost of power was $291,830 less than the amount of the interim bills, and this has already been rebated to the municipalities. Of the 141 operating municipalities in this system, with 289,680 customers, there were but eight reporting a total loss of $38,752. The net surplus accumulated during the year by the municipalities in this system was $706,499, in addition to $786,890 depreciation, or a total increase of $786,540 as compared with 1922.

All of the smaller systems show satisfactory results. On the Severn system there is but one municipality showing a gross loss of $52, while the 17 with over 8,000 customers operated with a net surplus of $55,900, after providing a depreciation reserve of $13,568. The Eugenia system, with 24 municipalities and 8,825 customers, had a net surplus of $32,113, after providing $17,418 for depreciation. There were but five municipalities on this system showing a total loss of $1,408, as against deficits of $3,629 in 1922, and $22,511 in 1921. On the Wasdells system every municipality operated with a profit, the net surplus provided by the 1,577 customers in the eight municipalities being $18,454, after setting aside a depreciation reserve of $2,045. The Muskoka system, with two municipalities and 972 customers, operated with a net surplus of $2,899, in addition to $2,090 depreciation; there were no losses. The St. Lawrence system, with 10 municipalities and 4,275 customers, showed a net surplus of $62,953, in addition to $5,816 depreciation. There were actual losses in three municipalities aggregating $1,931 out of a total revenue of $70,670.

The Rideau system, with five municipalities and 3,862 customers, showed a net surplus of $11,519 after providing for $7,738 depreciation. This surplus is considerably more than in 1922, largely due to the shortage of water in the winter of 1922-23, which necessitated the operation of auxiliary steam plants at Smith Falls for some time, with a consequent material increase in the cost of power. The Thunder Bay system, which, up to the present time, serves only the City of Port Arthur, with 4,026 customers, operated with a net surplus of $79,555 after providing for $7,737 depreciation. The Ottawa system, serving the City of Ottawa with 12,719 customers, operated with a net surplus of $45,092 after providing for $46,726 depreciation. The Trent system, consisting of 12 municipalities, with 14,088 customers taking power from the Central Ontario system, operated with a net surplus of $79,117, in addition to $20,993 depreciation. One municipality with but two months' operation shows a loss of $52. The summary shows that all systems operating under cost contracts with a total of 348,028 customers operated with the surplus of $1,093,753, in addition to providing a depreciation reserve of $916,783, which is 42.5 per cent. improvement over the corresponding figures for 1922.

The consolidated balance sheet of all "Hydro" municipalities shows total assets of $62,892,545, an increase of $50,984,718 since 1913 (428 per cent.). The surplus assets amounted to $6,921,956, as compared with $326,831 in 1913. In the same period the total revenue has risen from $2,617,440 to $17,219,044, and the net surplus from $313,581 to $1,093,753.

Each year a number of the municipalities connected to the organisation become free of debt; the number is now 30, 18 having reached this state during the past year. In addition to these there are 23 others whose excess of liabilities is so small that practically all of them will become clear during the current year.

Legal.

Anderson & Turner v. Rose.

MR. JUSTICE BRANSON, in the King's Bench Division on July 17th and 18th, heard a claim by Messrs. George Anderson and Herbert Turner, trading as the Electrical Motor Works at Tottenham, for £125 against Mr. John Rose, travelling showman, Hudson Road, Kingston-on-Thames.

Plaintiffs' case was that defendant ordered an 8 h.p. dynamo and motor from them in April, 1923, to use in connection with his roundabouts, the agreed price being £112 for the dynamo and £55 for the motor. Plaintiffs subsequently agreed to supply a 10-h.p. set at the same price. There was a 12 months' warranty, during which time plaintiffs undertook to repair or replace free of charge any part, or parts, which might get out of working order owing to faults in either material or workmanship. Plaintiffs disclaimed responsibility for repairs made or attempted to be made by other parties without their written consent. Defendant paid a deposit of £30 and the motor and dynamo, which were made in Belgium, were delivered on May 19th. On May 31st defendant telephoned to say that the motor had gone wrong. Plaintiffs found the trouble was caused by the starter being left half over, and put the matter right. On June 22nd defendant paid a further £15 on account. The motor was then inspected by plaintiffs and was found to be working quite well. The following day defendant telephoned to say there had been a breakdown. It was found that the cause of this trouble was that the motor and starter were wrongly connected. Another machine was hired while this repair was effected. The repaired machine was sent back to defendant on July 13th and on the 17th of that month Mr. Anderson tested it and found nothing the matter with it. The machine was still in defendant's possession.

Defendant counterclaimed for the return of the £45 which he had paid and for damages for losses alleged to have been sustained through engaging pitches and labour for shows and not being able to work at those shows owing to the failure of the machine. Defendant said he had sent the dynamo back.

MR. EDDY, for the plaintiffs, contended that the whole trouble was due to inefficient persons having charge of the dynamo and motor.

HIS LORDSHIP in his judgment said it was part of the contract that a speed regulator and starter should be supplied with the motor. The starter was not, in fact, supplied for some time after delivery of the motor and dynamo, and that led to trouble, the old starter being burned out once or twice. There was trouble after the proper starter was supplied and plaintiffs said that this was owing to improper connection. There was a mass of conflicting evidence, and he had to decide which side to believe. Forming the best conclusion he could, he must rely on the evidence of the defendant. Plaintiffs were, however, entitled to £55 for the motor which defendant had kept and used, but they had been paid £45 on account.

Defendant was entitled to reject the dynamo and to refuse to pay anything in respect of it.

Judgment was entered for plaintiffs on the claim for £12 10s. and for defendant on the counterclaim for £117 10s.

London Telephone (New System) Co., Ltd., v. Rownson, Drew & Clydesdale, Ltd.

In the Mayor's and City of London Court, on July 11th, before Judge Shewell Cooper, a claim was made by the London Telephone (New System) Co., Ltd., against Rownson, Drew and Clydesdale, Ltd., Upper Thames Street, E.C., for £8 8s. 8d., a quarter's rent for the hire of 16 internal telephone instruments, from April 1st to June 30th of the present year. Mr. Metcalf was counsel for the plaintiffs, and Mr. H. Infield and Mr. Bickmore represented the defendants. Mr. Metcalf said the defence set up was that the plaintiffs had failed to carry out the terms of their contract and had failed to keep the defendants' installation in an efficient working order, but he (counsel) submitted that that was not a defence to the action, but might possibly be the subject of a counter-claim for damages for breach of contract. The telephone system, he said, was installed in pursuance of three contracts; the first two contracts provided for maintaining the installation for the current year and for 21 years, and the third contract was for a period of 10 years. Apparently the instruments had been repaired on various occasions during the six years they had been in use, and at the present moment the installation was under inspection and repair. On May 14th, 1924, defendants wrote to determine the contract. Counsel, proceeding, said that plaintiffs replied that as the contract did not expire until the year 1939, they could not accept the termination of service. Defendants, in answer, said they did not intend to pay any more rent for the installation, and the proceedings were instituted. Mr. S. Wray, chief engineer of the plaintiff company, in giving evidence, said he inspected the installation at the defendants' premises in April last and found it was not in a very bad condition. He suspected that some of the cable required renewing, and that work was being proceeded with. The system was in fair working order, most of the points were communicating well. Mrs. A. L. Horrigan, telephone operator in defendants' employment, said that for at least a year the installation had been in a very bad condition. For the defendants it was contended there was a duty upon the plaintiffs under their contract to inspect and maintain in efficient working order the telephone installation at the defendants' premises. Judge Shewell Cooper, in giving judgment, said that from the evidence he was satisfied that the defendants' installation was not being maintained in efficient working order. Plaintiffs were therefore not entitled to recover the amount claimed. Judgment for the defendants with costs.

Feeder Box Damaged by Motorist.

At Burnley County Court, on July 17th, the Burnley Corporation sued John James O'Donnell for £54 10s. damage to an electric feeder box, caused in a collision. The feeder box controlled the district of Towneley, and was situated near to a hairpin bend. Defendant did not negotiate the corner properly, with the result that he ran straight into the feeder box. He was afterwards fined for being drunk while in charge of the car and for driving to the danger of the public. Defendant did not appear, and he was not represented, and His Honour found for the Corporation with costs.

Electro-Mechanical Brake Co., Ltd., v. Rheostatic Co., Ltd.

As briefly mentioned in our last issue, Mr. Justice Eve gave judgment, on July 15th, in the action tried in the previous week, in which plaintiffs sought an injunction to restrain the Rheostatic Co., Ltd., Slough, from infringing a patent granted to Alfred Walter Maley for an invention for improvements in the manufacture of electrical resistances.

His LORDSHIP said that the practical defect of the rheostats in and prior to 1909 (the year of the plaintiffs' patent) was their uncertainty in action and their loose connections due to unsuitable joints, and other difficulties caused by vibration. Speaking generally, their unreliability engendered a feeling of distrust towards regenerative braking in the minds of those who had to manage tramway undertakings. The patentee in this case endeavoured to overcome these defects, and in the case of the present invention his claim was for a grid resistance made out of one or more continuous lengths of selected material, in which all devices or methods for attaching the different grids were dispensed with. In his Lordship's opinion the claim could not be extended to cover a series of separate grids in which mechanical continuity was brought about by joining them. Mr. Maley's invention did not include a rheostat built up of grids originally disjointed and separate, and upon his Lordship's construction of his specification, the plaintiffs could not succeed in their claim for infringement. The defendants' rheostat was constructed of a series of grids stamped separately and joined by spot welding. He could not see that their rheostat was any infringement of the patent. His Lordship dealt with the prior specifications relied on by the defendants, and said he did not see any anticipation of the plaintiffs' patent. The plaintiffs failed in their action for infringement and the defendants in their defences other than that of non-infringement, and the plaintiffs must pay the costs of the action except in so far as they were increased by the defence of anticipation, and there would be a set off as to costs.

A discussion arose as to the costs, and this question was adjourned.

In the Chancery Division on July 16th Mr. Justice Eve dealt with the question of costs.

Mr. MORITZ (defendants' counsel) informed his Lordship that he had agreed with Mr. Trevor Watson (plaintiffs' counsel) in this matter. The latter suggested that the plaintiffs should pay one-half of the taxed costs without any set-off. There would be no taxation of costs if there was an appeal within a stated time.

His LORDSHIP assented to these terms.

Metropolitan-Vickers Electrical Co., Ltd., v. British Thomson-Houston Co., Ltd.

THE commencement of this case was reported in our last issue (p. 123). The plaintiffs alleged infringement of a patent for rotary converters by the defendants, who set up a defence of prior publication and prior general knowledge.

Upon the resumption of the case last week Dr. W. H. ECCLES, F.R.S., said that he was familiar with Rosenberg's specification. Before this invention it was customary to start a synchronous motor by an auxiliary motor. The invention described in Rosenberg's specification was a method of using an actuating current for speeding up and synchronising automatically a synchronous machine, the method consisting of connecting corresponding windings in series. The method, however, did not finish there—but connected the machine to the supply mains.

Mr. W. H. BALLANTYNE, patent agent, was examined by Mr. Whitehead. He said that he was one of the parties who attended the tests made at the defendants' works at West Hartlepool on March 21st last. With him on that occasion were Dr. Eccles and Messrs. Dennie, Cachemaille and Townend. Altogether he carried out four tests on the same machine and no tests were made on any other machine. In that machine the choke coils were behind the switchboard—the starting end. In carrying out his tests he made use of two voltmeters which he took with him and placed on the floor. The same connections were used in all the tests. A station attendant received instructions what to do with the switches and he carried them out. The witness then gave evidence in great detail as to the result of the tests which he had made and as to what he had noticed when the machine was approaching synchronous speed.

Sir ARTHUR COLEFAX, opening the defendants' case, denied that there had been any infringement by the defendants and contended that there had been complete anticipation of Rosenberg's alleged invention by Tesla's earlier specification, and therefore that Rosenberg's patent was bad for want of subject matter.

An Oil-Electric Shunting Locomotive.—A new type of electric locomotive, using oil fuel, the first of its kind in America, has been built jointly by the General Electric Co. (U.S.A.) and the Ingersoll-Rand Co. It is specially designed for switching service, and will be tested by the New York Central in its goods yards at 11th Street, New York City. The equipment consists of a 300-h.p. Ingersoll-Rand oil engine directly connected to a 200-kW General Electric generator, and four HM-840 motors, each of which is geared to one of the four axles. The locomotive has a total weight of 60 tons, all on the drivers.

The engine consumes about 0.43 lb. of fuel oil per b.h.p.-hr., and emits no smoke, so that it is particularly suitable for service in cities. As ordinarily used in switching service, the locomotive consumes about 20 to 26 cents' worth of fuel oil per hour. An unusual feature of the design is the use of a d.c. generator supplying current to the motors without intervening accelerating resistance. This is accomplished by using a differential series field on the exciter, which automatically reduces the generator voltage when the current taken by the motors increases. The speed of the locomotive therefore automatically increases as the load is reduced, in accordance with the rise in impressed voltage. This control eliminates the possibility of overloading the generator or motors or of stalling the engine. The main excitation of the exciter field is furnished by a storage battery, which also supplies control current and locomotive lights.

Permanent Subways for Electricity Mains, &c.—The agenda for last Tuesday's meeting of the London County Council contained the following motion by Mr. Shadforth:—"That in view of the proposal of the Government that a sum of £17,000,000 shall be voted for the telegraph service, a large proportion of which is to be expended on the laying of underground telegraph cables, it be referred to the General Purposes Committee to report upon the whole question of the possibility of constructing permanent subways to carry such cables and also to carry telephone cables, gas, water, and other services, with the object of the Council joining the Government in an effort to prevent the wasteful opening up of roadways and pavements."

Business Notes.

Our Issue of August 8th.—Our Advertisement Department draws attention to the fact that, owing to the August Bank Holiday, new copy and alterations to existing advertisements for the issue of the ELECTRICAL REVIEW for August 8th must be received by Thursday morning, July 31st, at the latest. All matter for our editorial pages will also require to be in our hands earlier than usual.

Bankruptcy Proceedings.—D. C. FIELDING, wireless dealer, 48a, Cloth Market, Newcastle-upon-Tyne.—Receiving order made July 11th, on debtor's own petition. First meeting, July 30th, at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne; public examination August 7th, at the County Court, Newcastle-on-Tyne.

R. HAMMOND, electrical engineer, 3, The Arcade, George Street, Richmond, Surrey.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., appointed July 9th.

M. C. JONES, the only "general partner" in M. C. Jones and Co., stockists of wireless parts and accessories, 239, Westgate Road, and 65, Thornton Street, Newcastle-upon-Tyne.—First and final dividend of 5s. 3½d. in the £, payable at Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne.

M. C. JONES (separate estate), wireless engineer, 10, Winchester Terrace, Newcastle-upon-Tyne.—First and final dividend of 1s. in the £, payable at Pearl Buildings, Northumberland Street, Newcastle-upon-Tyne.

C. J. COX (C. J. Cox & Co.), electrical and automobile engineer, Pontefract Road, Castleford.—Supplemental dividend of 6d. in the £, payable July 28th, at 9, Central Bank Chambers, Leeds.

L. A. RADFORD, electrical engineer, 50, Welford Road, Leicester.—Receiving order made July 14th, on debtor's own petition. First meeting July 25th, at the Official Receiver's office, 1, Berridge Street, Leicester; public examination August 15th, at The Castle, Leicester.

H. HUNT (in co-partnership with E. Hicks as Hicks, Hunt and Co.), electrical engineer, 1, Garston Street, Chesham, Bury, Lancs.—First meeting July 28th, at the Official Receiver's offices, Byrom Street, Manchester; public examination September 23rd, at the Court House, Bolton.

S. SCARFI (Scarfi Bros.), cycle, gramophone, and wireless agent.—First meeting July 25th, at 34, Park Place, Cardiff. Public examination August 12th, at the Town Hall, Newport, Mon.

C. WRIGHT & H. WRIGHT, electrical engineers, 251, Fulham Road, Chelsea, S.W.—Last day for proofs for dividend August 6th. Trustee, Mr. W. Strachan (Martin, Farlow & Co.), 50, Gresham Street, E.C.2.

H. PARR, electrician, 2, Strawberry Dale Square, and 1, Back James Street, Harrogate.—Last day for proofs for dividend August 16th. Trustee, Mr. W. A. Thompson, 112, King's Road, Harrogate.

B. N. HALSON, electrician, 29, Mayfield Road, Northfleet, Kent.—First and final dividend of 9s. 7½d. in the £, payable at the Official Receiver's office, 280a, High Street, Rochester.

Company Liquidations.—LONDON WIRELESS CO., LTD., late Premier Place, High Street, S.W.—Pursuant to Section 188 of the Companies (Consolidation) Act, 1908, a meeting of creditors was held on July 11th at Anderton's Hotel, Fleet Street, E.C., when the Liquidator, Mr. V. McDonnell, of 1, Dolby Road, Fulham, stated that the liabilities amounted to £1,325 and the assets to about £70, but that they were covered by a preferential payment for rent due.

The company was formed on April 21st, 1923, with a capital of £500, divided into 500 shares of £1 each, 482 of which had been issued as fully paid. The company started work on small amounts advanced by Mr. C. A. West, using the premises of Surrey Services, Ltd., and paying £2 per week rent, and £3 5s. per week on account of lighting, water, rates, &c. The company also paid £3 per week to Putney Garage, Ltd., for the use of plant, &c., that enabled the company to carry on without buying plant and machinery. The company commenced to manufacture 'phones, but owing to the Continental competition they took up the making of loud speakers and amplifiers, Mr. West giving the company permission to manufacture a l.f. amplifier. The Liquidator said that the directors had never drawn any fees. Payments for rent had not been met, and distraint was made by Surrey Services, Ltd., the amount of the distraint being £116.

A Creditor: Did the company ever pay any rent?

The Liquidator: No. He added that the sale of the goods produced £54 10s., and after the sheriff had been paid there was a net amount available of £34 16s.

After discussion Mr. Crosbie said that in his opinion the whole thing was very unsatisfactory, and he thought that a committee should be formed to investigate the position before any definite resolutions were passed. The solicitor representing Putney Garage, Ltd., proposed that the voluntary liquidation should be continued with the present liquidator. That proposal was seconded by the representative of Surrey Service, Ltd., but was not favourable to the meeting, which was eventually adjourned.

KELLY & TARSHIS, LTD., electrical engineers and dealers in wireless apparatus, 5, High Street, Shoreditch, London, E.—Under a winding-up order made against this company on January 29th last on a creditor's petition, the statutory meetings of the creditors and of the shareholders were held on July 15th at the Board of Trade Offices, 33, Carey Street, W.C. The Official Receiver said that the company was incorporated on March 12th of last year with a nominal capital of £1,000, divided into shares of £1 each, and it was formed to acquire and carry on the business of electrical engineers which had been conducted by Thomas Kelly and Nat Tarshis under the style of Kelly & Tarshis, and generally to carry on the business of electrical engineers. Kelly & Tarshis were the promoters and by a resolution of the board their salary as directors was fixed at £12 each. They said that they had previously carried on business for some years with success and considered that they had been enabled to draw £5 to £10 a week from it. Early last year they began a retail wireless business which they worked in conjunction with the electrical business. They were approached by Arthur Alexander Gould, who suggested their promotion of a company "as there was money to be made," and he hoped to subscribe £1,000 capital. There had been disputes regarding financial matters between Tarshis & Kelly, and with a view to placing their personal position as partners on a proper basis it was decided to form the company. Unfortunately the £1,000 was not forthcoming from Gould because his wife when she knew the purpose for which the money was required refused to sell a house belonging to her out of the proceeds of which it was intended to provide it. The company bought the goodwill, lease, &c., of the business of Kelly & Tarshis at 5, High Street, Shoreditch, for £500 in fully paid shares but no assignment of the lease to the company actually took place. From the date of the promotion Gould took an active part in the business which from the point of view of electrical engineers was practically discontinued in favour of wireless apparatus. Gould had stated that the company was at first financed by the directors by way of loans. He himself had advanced it £687, in consideration of which he was employed as a traveller at £8 a week. Debentures had been issued to him, but since they had been issued within three months of the presentation of the petition to wind up they were invalid in respect of advances made before December 12th last. Gould was therefore now an unsecured creditor for £537. Gould and Tarshis did all the buying and selling and Kelly states that he was never consulted. The failure of the company was attributed to the constant disputes which took place between the directors, keen competition, lack of capital and the rapid way in which wireless instruments and patents became obsolete owing to improvements which were of daily occurrence. In the opinion of the Official Receiver the failure was due to the entire lack of capital and gross mismanagement on the part of the directors, who appeared to have allowed themselves to be controlled by Gould throughout. In the absence of any resolutions the liquidation was left in the hands of the Official Receiver. The statement of affairs filed in the proceedings showed total liabilities £4,327, of which £4,096 is unsecured and no available assets.

The following are creditors:—

	£		£
Accumulators, Ltd.	184	K.G. Motor & Eng. Co.	21
Berk, N.	134	Kelly, T.	100
Berk & Co., Ltd., ...	134	Langham Elec. Supplies, Ltd. ...	80
Bewleys, Ltd.	25	Lelias Lamp Co., Ltd.	17
Condor Lamps (Gt. Britain), Ltd.	37	Merchants & Agents, Ltd.	132
Chorley, R. & C.	16	Oldham & Sons, Ltd.	90
Crystalate Mfg. Co., Ltd. ...	19	Le Parsonne	425
Edison Swan Electric Co., Ltd.	83	Pirelli, Ltd.	146
Elec. Eng. & Equip. Co., Ltd. (in liquidation)	41	Repaults	122
Ebonestos Insulators	26	Sloan Electrical Co., Ltd. ...	160
Fair, W. C., & Co.	25	Stokes, C. H.	132
C.H.J. Trading Co.	31	Szilagya, L. F.	24
Hart Accumulator Co., Ltd. ...	188	Tarshis, Nat.	168
Hough, Ltd.	264	Vacuum Oil Co., Ltd.	10
Hannah, H. S.	302	Wade & Sons, Ltd.	24
Higgs Bros.	176	A. E. Gilbert & Co., Ltd., ...	425
		Nicholsi Behr	25

LOWKE, JERSEY, LTD.—With reference to this voluntary liquidation, mentioned in our last issue, Messrs. Lowke & Sons, Ltd., electrical and general engineers, of Northampton, state that they disposed of all interest in Lowke, Jersey, Ltd., last year.

WALLACE (GLASGOW), LTD.—Winding up voluntarily. Liquidators, Mr. A. Murdoch and Mr. J. Winning, 53, Bothwell Street, Glasgow.

STENTOPHONE MOTOR ACCESSORIES (1921), LTD., Birmingham.—Mr. T. D. Neal was appointed receiver for the first debenture-holders as from June 7th. Liquidator: Mr. A. Cripwell, 12, Cherry Street, Birmingham.

TINGEY WIRELESS, LTD.—Winding up voluntarily. Liquidator, Mr. A. J. Foster, 37, Walbrook, E.C. Meeting of creditors August 1st, at the offices of the Liquidator.

SCHOLEY & CO., LTD.—Winding up voluntarily. Liquidator, Mr. G. Smith, 137, Victoria Street, S.W. Meeting of creditors July 31st, at Caxton Hall, Victoria Street, S.W.

LYME REGIS ELECTRIC LIGHT & POWER CO., LTD.—Winding up voluntarily. Liquidator, Mr. L. W. Hawkins, Basildon House, Moorgate, E.C.2. Meeting of creditors July 28th, at Basildon House. Particulars of claims to the Liquidator by August 30th.

AUCKLANDS WIRELESS, LTD.—Particulars of claims by August 12th to the Liquidator, Mr. F. G. Jenkins, 5, Philpot Lane, E.C.

RE-ECHO ELECTRICAL MANUFACTURING CO., LTD.—The first meetings of creditors and contributories were called for July 24th, at Carey Street, W.C.

ASHLEY WIRELESS TELEPHONE CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Dewhirst, 2, Inner Temple, Dale Street, Liverpool. A meeting of creditors was called for July 25th, at 21, North John Street, Liverpool.

Private Arrangements.—O. G. HOFFMAN, trading as L. J. Chambers & Co., wireless manufacturers and electrical engineers, Andrew Works, Cowthorpe Road, Wandsworth, S.W., and Victoria House, South Lambeth Road, London, S.W.—A largely-attended meeting of the creditors of the above was held recently at the offices of Messrs. Brown, Peet & Tilley, C.A., Mark Lane, E.C. The statement of affairs presented showed liabilities of £2,769, of which £2,136 was due to the trade and £634 to cash creditors. The assets consisted of:—Stock-in-trade, estimated at £200; and book debts, £110; making total assets of £310, or a deficiency of £2,459.

Mr. W. PEET stated that the position was somewhat complicated, and the information in his possession was rather meagre. There was a claim for £350, which had not been included in the liabilities. That claim was in respect of money advanced, but it was said that the debt had been satisfied. The stock on the premises had not been valued in detail. The premises were bolted and barred, and consequently the stock could not be inspected. On June 13th last the debtor executed a bill of sale for £600. The debtor stated that he did not receive the £600 represented by the bill of sale, and the transaction did not appear in the books. In addition, the money did not pass into the debtor's banking account. Further inquiry regarding that matter appeared to be desirable, but there was no doubt that the bill of sale holder had paid various items on behalf of the debtor. The bill of sale holder appeared to have paid £138 on account of the debtor's car, £54 for two vans, £70 for electricity, £76 for rent, and other items making a total of at least £470. The bill of sale holder put a man in possession, but it was believed that that man was forcibly ejected, and the premises were then locked up. Possession would again be taken if occasion offered. Mr. Peet next referred in detail to a number of transactions in which a quantity of the debtor's stock and other assets were sold, or parted with. The person who obtained that stock and assets was given receipts, but apparently the money never passed. It had been suggested that the matter should be dealt with under a deed of assignment, but in view of all the circumstances of the case the creditors would probably think that bankruptcy was desirable. It was necessary to ascertain if payment had been made for the goods which had gone, and as far as he could see about £1,000 worth of assets had disappeared.

The representative of the Crystalate Manufacturing Co. said that he was in favour of bankruptcy taking place, as the transactions in question required further investigation.

After further discussion, Mr. HOUSTON said his view was that, unless the estate was put back into its original position, it should be wound up in bankruptcy.

Several creditors supported this suggestion, and it was also decided that if an offer of approximately 15s. in the £ was forthcoming it should be accepted. A committee consisting of the creditors interested for more than £100 each was also appointed.

The principal creditors are:—

	£		£
New Eccles Rubber Works ...	335	J. Ludkin	80
Aster & Mander (1917), Ltd. ...	86	W. G. Stewart	67
E. Castell	71	Reece & Patton	178
D. M. Henderson & Co.	141	Cable Electric Supplies Co. ...	92
Aka Co.	83	W. H. Briscoe, Ltd.	121
Crystalate Manufacturing Co., Ltd.	288	Bankers	500
Spicers, Ltd.	84	Rollitt & Co.	89
J. Ellis & Co.	105	Money, Hicks & Wills	97

ROBERTSON & SON, ironmongers and electrical engineers, 86, George Street, Edinburgh.—The adjourned meeting of the creditors of the above (see ELEC. REV., July 11th, p. 60) was held recently, in Edinburgh, when the representative of Messrs. Wood & Cairns was elected to the chair. A statement of affairs was presented showing the position as at July 4th last, and this disclosed liabilities of £6,628, made up as follows:—Preferential claims, £256; trade creditors, £3,624; cash creditors, £1,881; and bank overdrafts, £866. The two banks interested held third-party guarantees for the full amount of their claims. The assets were estimated to realise £5,899, or a deficiency of £728. The assets consisted of:—Book debts, £1,213, expected to produce £970; stock, £4,658; working tools, furniture, &c., £250; and cash in hand, £21. The estate showed a dividend of 17s. 8d. in the £, subject to expenses of realisation. The chairman reported that the committee of creditors appointed at the previous meeting had conferred with the trustees of the late Mr. Robertson, and he was authorised to submit proposals for the payment of the debts in full. It was suggested that the trade creditors whose accounts did not exceed £5 should be paid in full within one month, and that the remaining trade creditors should be paid 20s. in the £ by three instalments of 6s. 8d. each on November 1st, 1924, April 1st, 1925, and August 1st, 1925. Those instalments would be secured. A resolution was unanimously passed accepting the offer made.

Dissolutions of Partnership.—JOHN DRAKE & Co., electrical engineers and wholesale and retail ironmongers, London Road, Sunningdale.—Mr. E. J. H. Bluett and Mr. A. T. Archer have dissolved partnership. Mr. Archer will attend to debts and continue the business.

G. W. SMITH, plumbers and electricians, 9, Croft Road, Blyth, Northumberland.—Messrs. G. W. Smith, T. Waddle, J. Robinson, and P. L. Stokoe have dissolved partnership. Messrs. Robinson and Stokoe will attend to debts.

ACCUMULATOR MAINTENANCE CO., electrical and accumulator experts, 267, High Street, Camden Town, N.—Mr. G. D. Le Lièvre and Mr. S. W. Webb have dissolved partnership. Mr. Le Lièvre will attend to debts and continue the business.

COWAN & FOX, wholesale electrical suppliers, 35, Dickinson Street, Manchester.—Mr. J. Cowan and Mr. W. J. R. Fox have dissolved partnership. Mr. Cowan will attend to debts and continue the business under the same style.

Trade Announcements.—MESSRS. J. & W. B. SMITH, of Farringdon Road, E.C.1, state that they are redecorating and renovating their showrooms which were affected by the recent fire, and new trade catalogues are being prepared for the coming lighting season. Various departments have been reorganised, and the company is concentrating upon stock lines. Mr. Frederick Watkinson is not now connected with the company.

THE ELECTRO DYNAMIC CONSTRUCTION CO. has removed its works to larger premises, and its new address is 6, Malt Street, Old Kent Road, S.E.1.

The undertaking of the Okehampton Electric Light Co., owned by Mr. G. K. Blatchford, has been disposed of to W. G. Heath & Co., of Plymouth.

Catalogues and Lists.—THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Catalogue Section W (1), a complete price list of Pirelli-General wires and cables of all types and sizes. Catalogue Section L (1), containing full particulars, illustrations, and prices of electric bells and accessories. Also a pamphlet advertising electric flashlight lamps.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Descriptive Lists No. 2,142 D, "Single- and Polyphase Induction Motors"; No. 5,000, "Non-automatic Electric Control Gear"; and No. 5,680, "Automatic Sub-station Control Equipments." Also Price List No. 5,610—Section 1, "A.C. Contactor Control Equipments for Non-Reversing Polyphase Slip-ring Induction Motors." Fully illustrated.

Also an illustrated and priced pamphlet advertising head telephones, multi-way telephone switches, &c.

THE S.R.O. BALL BEARING CO., 115, Southwark Street, S.E.—Catalogue No. 15, containing full particulars and prices of "S.R.O." ball bearings for various applications.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Playhouse Yard, Golden Lane, E.C.1.—Price lists of single flexible, flat and round twin, and various other C.M.A. cables.

THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Circulars No. 1,426/1, illustrating and describing the construction of turbo-alternators; No. 1,370/3, containing an illustrated description of the company's large power transformers; and No. 1,442/1, dealing with Metropolitan-Vickers high-pressure steam turbines. Each of the publications includes views of actual installations.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Leaflet No. 1,034, containing illustrations and prices of conduit fittings, including new ranges.

THE TRANSFLECTOR CO., LTD., 28, John Street, Theobald's Road, W.C.1.—An illustrated catalogue of "Transflector" mirror showcases. Priced.

MESSRS. J. SHAW, SON & GREENHALGH, LTD., Albert Works, Huddersfield.—A well-illustrated catalogue (229 pp.) of steam apparatus, including high-pressure valves, boiler mountings, check, stop, and slide valves, gauges, cocks, steam dryers, &c.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—A mailing card advertising "Wild-Barfield" electric furnaces for the hardening of tools. Also an illustrated pamphlet dealing with electric radiant-heat furnaces for temperatures up to 1,000 deg. C.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C.—A circular letter advertising a new design of "Universal" desk and bracket fan.

THE SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., of Upper Thames Street, E.C.4, has prepared for distribution among its friends, particularly from its stand at the British Empire Exhibition, an advertising novelty which takes the form of a roulette game. By sweeping the edge of the hand across the celluloid top a tiny model of a lamp in the cardboard case is made to move, and it comes to rest on or over a numbered space.

SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester.—Descriptive Section No. 22, illustrating and giving details of a safety oil switch-fuse and transformer for colliery lighting. Priced.

MESSRS. PETO & RADFORD, 50, Grosvenor Gardens, S.W.1.—An illustrated leaflet dealing with "Gravity Float" accumulators, in which a visual indication of the state of charge is given.

THE ORION ENGINEERING CO., LTD., 73, Exchange Buildings, Birmingham.—An illustrated publication giving full details and prices of "Orion" 0.75-1.5-kW electric lighting sets.

MESSRS. FREDERICK BRABY & CO., LTD., Petershill Road, Glasgow.—A "Book of Braby Products" issued in connection with the British Empire Exhibition, describing the firm's exhibit and illustrating many examples of its manufactures.

MESSRS. RUSTON & HORNSBY, LTD., Lincoln.—Publication 4,634, containing a list of users of the company's cold-starting oil engines, together with reports on tests on these.

THE WALSALL HARDWARE MFG. CO., LTD., Hatherton Works,

Ablewell Street, Walsall.—A well-illustrated catalogue giving details and prices of "Walsall" conduit fittings, switches, plugs, and sockets, &c.

MESSRS. L. WEEKES, LTD., Luton, Beds.—An illustrated catalogue of cartridge fuses, switch fuses, mine switchgear, switchboards, &c. Fully priced.

Some Recent Contracts.—MESSRS. STUART TURNER, LTD., Henley-on-Thames, have just delivered twelve 120-watt generating sets to the Post Office for the telephone service, and have received a further order for 30 similar sets. They have also received a repeat order from Marconi's Wireless Telegraph Co. for twelve ¼-kW sets.

Book Notices.—Circular No. 74 of the United States Bureau of Standards. "Radio Instruments and Measurements." (345 pp.; 218 figs.). Washington: Government Printing Office. Price 60 cents.—This is a revised edition of a circular originally issued in 1918. It contains a brief summary of the principles involved in radio work, and describes succinctly many appliances for the transmission, reception, and measurement of radio waves.

"Official South African Municipal Year Book, 1924-25." (Pp. 463.) London agents: Messrs. E. G. Allen & Sons, Ltd., 12, Grape Street, W.C.2. Price 25s. net.—All the valuable features which characterised the earlier issues of this Year Book have been retained, and brought up to date by the inclusion of 1923 figures and facts. The Electric Light and Power section contains full particulars of all the municipal undertakings, as well as six alphabetical tables giving general particulars of the plant, output, number of consumers, &c., of municipal and company systems; details of generating equipment; financial details; tariffs of charges; and particulars of tramways and bulk supply. A general review of 1923 contains the information that new stations have been opened up in Rustenburg, Caledon, Frankfort, and Robertson, and that the total expenditure on power stations (including tramway plant) has risen from £8,135,429 to £9,165,157.

"The *Bulletin* of the British Cast Iron Research Association, June, 1924." (35 pp.). Birmingham: The Association.—This *Bulletin*, which in future is to be issued regularly each quarter, contains a report of the annual meeting of the Association, at which the president (Lord Weir of Eastwood) and the vice-presidents were re-elected. A list of the new Council is given. The principal matters dealt with in short articles are "Rustless Cast Iron" and the "Standardisation of Photomicrographs" (from *Stadt und Eisen*). Other items are additions to the library, a large number of abstracts of articles from the world's literature dealing with iron, &c., and a list of recent British and foreign patents in connection with cast iron, &c.

"The Calculation and Measurement of Inductance and Capacity," by W. H. Nottage. Pp. viii+224; figs. 80. Price 7s. 6d. "Thermionic Tubes in Radio Telegraphy and Telephony," by J. Scott-Taggart. Pp. xxiv+470; figs. 388. Price 15s. "Thermionic Valve and its Development in Radio-Telegraphy and Telephony," by J. A. Fleming. Pp. xiii+438; figs. 280. Price 15s. London: Wireless Press, Ltd.

"The *Quarterly Bulletin* of the Institution of Engineers, Australia." Vol. I, No. 2, April, 1924. Sydney (N.S.W.): The Institution.—The greater part of this *Bulletin* is an account of the proceedings at the Institution's third Engineering Conference, which was held in Brisbane from March 31st to April 4th. A large number of interesting visits are described, among the places covered being the power station of the City Electric Light Co., Ltd., Brisbane, the engineering laboratories of the University of Queensland, and several factories of a diverse character. At the annual meeting Senator J. D. Millen was installed as president after an address by the retiring president, Prof. R. W. Hawken. The publication includes a statement of accounts which shows a satisfactory position.

"The *Transactions* of the South African Institution of Electrical Engineers." April and May, 1924. Johannesburg: The Institute. Price 2s. per issue.—The April number of this journal includes an article on the "Electrical System of Welding," by C. N. O. Dutton, and a discussion on "Recent Developments in Automatic Telephony." The May issue reproduces a paper on "The Preheating of Combustion Air," by J. B. Bullock, B.A., and "Notes on Electrically Operated Hoists," by R. Bewick.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII. No. 331. July, 1924. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—The July issue contains papers by Mr. A. S. Fitzgerald on "The Design of Apparatus for the Protection of Alternating-Current Circuits," and by Mr. E. Hughes on "The Rise and Distribution of Temperature in Small Electrical Machines."

"A Dictionary of Electrical Terms for Electrical Engineers and Students," by S. R. Roget. Pp. xii+296. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

"Post Office Electrical Engineers' *Journal*." Vol. XVII. Part 2. July, 1924. London: ELECTRICAL REVIEW, Ltd. Price 2s. net.

"Engineering Abstracts." New Series. No. 20. July, 1924. London: Institution of Civil Engineers.

"*Wireless World* Directory of Experimental Transmitting Stations and Regular Transmissions." London: Wireless Press, Ltd. Price 1s. net.

The Portuguese Electrical Market.—The United States Assistant Trade Commissioner at Madrid, reporting on May 31st, stated that the fluctuation of the exchange value of the currency was seriously limiting the amount of business done with all nations except Germany. By a system of good agents and prompt deliveries German electrical equipment manufacturers were not only recovering their pre-war lead in this market, but were presenting serious competition with English and American houses, who, until recently, had encountered but very little actual rivalry in the sale of certain specified lines. Although some of the German equipment was of poor quality, this was by no means the case generally. The Trade Commissioner, therefore, warns American manufacturers that their former superiority in quality must not only be maintained, but must be accompanied by attractive prices, credits, and "service factors." In conclusion the official gives a list of the principal sources of electrical equipment supplied to Portugal, as follows:—Generators—United States, Switzerland, Germany, Belgium; transformers—United States, Belgium; meters—Germany, France; incandescent lamps—The Netherlands, Germany, France; insulated cables and wires—Germany, Italy, France; non-insulated cables and wires—Germany, Italy, Spain, France, Belgium; apparatus for domestic use (irons, toasters, fans, &c.)—Germany, France, Spain; miscellaneous, including bells, buzzers, indicators, &c.—Germany, Switzerland.

Unemployment.—During the week ended July 7th there was an increase of 14,956 in the number of persons registered as wholly unemployed, bringing the total up to 1,024,000; this, however, is 261,223 less than the total on December 31st, 1923.

The analysis of the unemployment figures as at June 23rd in the July *Ministry of Labour Gazette* shows that the total number of unemployed in the electrical wiring and contracting industry in Great Britain and Northern Ireland was 1,039, a percentage of 8.8. In the electrical cable, wire, and lamp manufacturing industry the number was 5,241 (7.7 per cent.). The gas, water, and electricity supply industries are grouped, and the total given is 9,942 (5.7 per cent.). The tramway and omnibus services had a total of 3,251 unemployed (5.1 per cent.). It is satisfactory to note that employment increased in all cases during the month covered by the analysis.

Catalogues Wanted.—MR. WM. C. MERCER, who has been appointed electrician-in-charge at the Scout Dam Waterworks, Penistone, Yorkshire, for the Barnsley Corporation, wishes to receive lists, &c., of motors, cables, transformers, switchgear, &c.

MR. SYDNEY PERKINS, electrical engineer, of Marshall Street, Leeds, asks for lists, &c., of power, lighting and wireless apparatus.

MR. H. J. ARTHUR, electrical engineer, 65, Cannock Road, Wolverhampton, asks for catalogues of wiring supplies, electric fittings, domestic appliances, &c.

British Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications the name and address of the British representative are also given:—

B. & D. The Black & Decker Manufacturing Co., Baltimore, Md., U.S.A. (lettering and design). No. 442,399. Class 6.—Portable electric drills and parts thereof, portable electric screw, bolt and nut drivers, portable electric air compressors, and portable and stationary grinders. The Black & Decker Manufacturing Co., 600, East Pennsylvania Avenue, Towson Heights, Baltimore, U.S.A. (McKenna & Co., 31-2 & 35, Basinghall Street, London, E.C.2.) July 16th, 1924.

Canning. No. 444,983. Class 6.—Electro-plating, polishing, lacquering, burnishing, bronzing, dipping, and enamelling machinery and parts. W. Canning & Co., Ltd., 133-137, Great Hampton Street, Birmingham. July 16th, 1924.

Listophone. No. 446,579. All goods in Class 8.—Lewis T. M. Pennington, 20, Kingsway, London, W.C.2. July 16th, 1924.

Devicon. No. 448,461. Class 8.—Apparatus for use in wireless telephony. The Radio Devices Co., 33, Mansfield Road, Nottingham. July 16th, 1924.

Jesbec. Nos. 449,255, 449,235. All goods in Class 8.—John S. B. Clark, 77, London Road, Redhill, Surrey. July 16th, 1924.

Buck (lettering and design). No. 447,563. Class 13.—Electric switches. The J. W. Buck Switch Co., 39, Victoria Street, London, S.W.1. July 16th, 1924.

Ventex. No. 442,348. Class 16. Electric fuse holders, fuse bases, and fuse contact shields, all being made from porcelain or earthenware. Holmes & James, Ltd., Excelsior Works, Ellis Street, Birmingham. July 16th, 1924.

New French Companies.—A company has just been formed in Paris (60, Rue de Provencey) with a capital of two million fr. and the title La Société Financière pour Favoriser le Developpement de l'Electricité et des Industries Nouvelles (Electro-Credit).

La Société des Lampes Gramme is the name of a company which has lately been formed in Paris (29, Rue d'Hautpol) with a capital of 1,800,000 fr., to acquire and develop the Gramme lamp business.

British Empire Exhibition Notes.—The British Horological Institute has published an interesting booklet in connection with its exhibit at Wembley. This is a review of British achievement in the sphere of clock and watch making, and describes and illustrates a number of masterpieces of

art and workmanship. The booklet is published at 8d. (post free), and the proceeds are to be devoted to the objects of the Institute, one of the principal of which is the training of men in the art.

On July 11th a party of 2,000 of the employés of the General Electric Co.'s Witton Works, accompanied by Dr. C. C. Garrard, Dr. R. Orsettich, and Messrs. Heaton and Morris, and other officials of the company, visited the Exhibition. No organised tour was arranged, the visitors being left to their own devices, except for lunch, which was taken at the Stadium Restaurant and the Regent Café.

Threatened Strike of Electricians.—On July 18th, the result of the ballot of the members of the Electrical Trades Union was made known. Out of a membership of almost 30,000, 7,630 were in favour of striking to enforce their demand for an increase of 10s. per week, while 5,112 were against strike action, a majority of 2,518 in favour of a strike. The form of ballot paper employed asked for the opinion of members upon arbitration, and the result involves a refusal to take this course. While the vote, considered as a whole, favours a cessation of work, it is reported that in several districts the vote went the other way. A meeting of the 40 unions which will be involved if the strike takes place was to be held on Wednesday last.

Annual Holidays.—Messrs. REAVELL & CO., LTD., of Ipswich, announce that their works will be closed for the annual holidays from Saturday, August 2nd, until Monday morning, August 11th.

The Leicester offices of Messrs. E. BROOK, LTD., will be closed for the annual holiday from Friday, August 1st, to Monday, August 11th. Urgent business will be dealt with from the head office at Huddersfield.

German Competition in Spain.—The *Daily Mail* says:—"Britain has just lost to Germany a valuable order from Spain for machinery and electric equipment. The lowest British tender was £128,000, and the lowest German tender £80,000. Duties under the existing commercial treaty and other charges, together with the effect of the exchanges, would have brought these two tenders practically into line, but a royal order has been issued removing the duty on machinery required for industrial improvements in Spain, thereby nullifying the protection to Britain."

American Foreign Trade Convention.—A report on the eleventh annual National Foreign Trade Convention, held at Boston in June, has been received by the Department of Overseas Trade from H.M. Consulate-General there. Some 2,000 delegates from various parts of the United States met to discuss questions of mutual interest and to listen to addresses delivered by prominent business men. The following were among the main topics of discussion:—The training of students for a foreign trade career; American banks and overseas trade; securing new customers in foreign lands; the profit side of exports; American loans abroad and foreign trade; collection of overdue accounts; extension of parcel post service abroad; transportation; United States Mercantile Marine; advertising; foreign credits and credit information. A number of United States Government officials, such as commercial attachés from the Bureau of Foreign and Domestic Commerce, attended the Convention.—*Board of Trade Journal.*

Loud Speakers.—MESSRS. ALFRED GRAHAM & CO. ask us to notify our readers that they cannot accept responsibility for any Amplion loud speakers from which their nameplates have been removed.

The A.E.G. in Jugo-Slavia and Holland.—The *Deutsche Allgemeine Zeitung* learns from Belgrade that in addition to the already existing Jugoslav A.E.G., a new company is being founded at Belgrade by the Allgemeine Elektricitäts Gesellschaft, which will represent the interests in Jugo-Slavia of the Linke-Hoffman-Lauchhammer-Selesia-Mix and Genest-Caro-Archimedes concerns, &c. The new company will bear the name of Technische Handels Aktiengesellschaft, and branches will be established in all the chief towns of the country. The Tetrad (the abbreviated title of the firm) will erect great telephone and telegraph works at Belgrade, which have hitherto been wanting in Jugo-Slavia, and devote special attention to the development of radio work in the country. One of the founders, and a large shareholder in the new concern, is the Serbian Ristitch firm, which existed before the war, and previously represented the A.E.G. It is planned to build extensive warehouses at Semlin in the autumn for the storing of the products of all the works belonging to the concern. The formation of the new company is a result of the constantly increasing competition in Jugo-Slavia of Hungarian and British firms. In Holland authorisation has been obtained for the establishment of the Internationale A.E.G. at Amsterdam, the founders being the A.E.G. in Berlin and the Amsterdam Bank. The capital amounts to 10 million gulden divided into 1,000 shares of 10,000 gulden each. The company intends to trade in electrical installations, machinery, and instruments. *Reuter's Trade Service* (Berlin).

Bobbed Hair and Curling Irons.—It is said that 5,000 women are having their hair bobbed in New York City every day at the present time. One effect of this fad throughout the country is to bring a tremendous market to the manufacturers of electric curling irons. One Middle Western company alone, for instance, reports that it is at present receiving orders totalling daily more than 20,000 for a certain type of curling iron—and there are many other makers. So great is the influence of a popular demand upon the production of any device. It is because the electrical industry is so young in this popular market that such figures seem spectacular. . . . At any time some social fad may bring exaggerated demand for a teapot or a toaster or a certain type of lamp or some other present or future device. The central station sales department and the electrical dealer, as well as the wholesalers and producers, have not yet learned to feel the popular market pulse quickly and play to a fad as they do in other older industries. Bobbed hair presents an opportunity in every community. The day will come when such a situation will be met with the keenest kind of selling activity by every retailer of electrical appliances. It will mark another stage in the commercial development of the electrical industry.—*Electrical World.*

Engineers' Wages.—At a meeting held in London on July 16th between employers and trade union representatives of the engineering industry a definite decision was presented refusing to accede to the men's request for a general increase of 20s. per week; no alternative proposals were made. This appears to end the conference initiated by the employers to consider means of bringing about peace and settlement in the industry. The demand for increased wages was based on a statement that the wages of skilled engineers were only 45 per cent. above the pre-war level, whereas the cost of living was well over 70 per cent. higher.

The trade union representatives are reporting the result of the meeting to their executives, which will confer upon the question of future action. It was stated by Mr. J. T. Brownlie, president of the Amalgamated Engineering Union, that the application for a 20s. increase would be adhered to.

Lighting and Power Notes.

Abergele and Pensarn.—SPECIAL ORDER.—The Urban District Council has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the town and in certain parishes in the rural district of St. Asaph.

Algeria.—ELECTRICAL DEVELOPMENT.—According to the report for last year of the Société Algerienne d'Eclairage et de Force, the output of the Hussein-Dey generating station, which serves the Algiers district, increased from 21,974,470 kWh in 1922 to 22,725,850 kWh in 1923. The distribution network has been extended as far as Bordj Menaiel on the east side, and on the west to Manengo, both districts being about 37½ miles from Algiers. The company's network now extends over a zone 75 miles wide, parallel to the sea. The Mers-el-Kebir station in the Oran district increased its output from 4,517,440 kWh in 1922 to 5,242,961 kWh last year. In order to meet the increasing demand, four new boilers are to be installed. An 18,000/30,000-V transformer station has been completed, and transmission lines erected to feed the outer area of the district served. Power is now being supplied to the mines at Beni Sap belonging to the Compagnie des Minerais de Fer Magnetique de Mokta-el-Hadid.

Annfield Plain (Co. Durham).—ELECTRICITY EXTENSIONS.—The Urban District Council is to erect a new sub-station at New Kyo and to extend its mains at an estimated cost of £2,700.

Australia.—PERTH (W.A.)—Mr. W. N. Taylor, general manager of the Electricity Department, states that in two years' time the estimated load upon the East Perth power station will be from 15,000 to 16,000 kW, with an annual output of 51,000,000 kWh. To provide for the extension of the supply it is proposed to purchase a 12,500-kW turbo-alternator and condensing plant, together with boiler-house equipment.

SYDNEY.—The City Council is spending £375,000 in replacing the overhead high-pressure conductors by underground cables. The portion of the system to be first dealt with will be that lying within the municipalities of Alexandria, Vaucluse, Waterloo, Waverley, and Woollahra, at an estimated cost of £34,000.—*Reuter's Trade Service* (Melbourne).

Canada.—TORONTO.—The thirteenth annual report upon the Toronto Hydro-Electric System, covering the year 1923, records a total income of $7,353,228, and an expenditure of $5,159,002, leaving a gross surplus of $2,194,226. The contributions to sinking fund, interest, depreciation, taxes, &c., absorbed $2,062,169, making the net result a profit of $132,056. In accordance with the established policy, this has been transferred to reserve for the stabilisation of rates. The amount of energy sold was 392,367,546 kWh, as compared with 338,103,673 kWh in 1922. The connected load rose from 374,803 to 451,898 h.p., and the maximum simultaneous demand from 140,393 to 155,741 h.p. The extensions carried out during the year included the installation of three 5,000-kVA and three 1,000-kVA transformers at two sub-stations, 825 pole-type transformers with an aggregate capacity of 21,550 kW, and 146,633 ft. of 13,200-V, 3-phase distribution cable.

Clacton-on-Sea.—YEAR'S WORKING.—The report on the working of the Urban District Council's electricity undertaking (engineer: Mr. G. Broadhurst) for the year ended March 31st last shows a total revenue of £13,170, as compared with £10,623 in the previous year. Working expenses totalled £5,729, as against £5,229, leaving a gross surplus of £7,441

(£5,394). After deduction of income tax, loan charges, &c., there was a net profit of £3,542, as compared with a profit of £756 in 1922-23.

LOANS.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for sanction to the borrowing of £1,000 for meters, £6,630 for mains, and £2,500 for services.

Continental.—CZECHO-SLOVAKIA.—Writing on the position of the electrotechnical industry in Czecho-Slovakia, Professor Pohl states that there are at the present moment some 350 public generating stations, about half of which are municipal, in course of construction, and the plans for 150 others are under preparation. Having regard to the comparatively moderate amount of water power available (in the aggregate 700,000 kW, but at low-water periods only 150,000 kW), the satisfaction of an annual demand of three milliard kWh renders resort to steam power a necessity. A 100-kV distribution network covering the whole load, and also a 22-kV network are being erected, and the State has sanctioned a preliminary credit of 75,000,000 crowns towards supplying current-distributing apparatus for the whole country. Of existing stations and those under construction, more than one-half are situated in Bohemia (North Bohemia alone has 82), 10 per cent. are situated in Slovakia, and the remainder are in Moravia and Silesia. Besides the Prague generating station, with 22,000 kW installed capacity and 40,000,000 kWh yearly output, there are the North Bohemian Turnitz-Bodenbach station (25,000 kW, 35,000,000 kWh); the Oslawaner station (19,000 kW., 40,000,000 kWh); and the Reichenberg and Trauknau stations. As auxiliary to the Prague station, there is under construction at Seestadtl, near Brüx, a brown coal-fed station of 45,000-kW capacity, which will be connected with Prague by a 100-kV line; and a water-power station on the middle Moldau, near Stechowitz. The total outlay for the electrification of the country may amount to 1,200,000,000 crowns, of which, since 1913, about 300,000,000 crowns has been spent. The electrical industry has attained to considerable development, over 300 firms being engaged in all its branches.

GERMANY.—As a result of an agreement between the Bayernwerk Gesellschaft, the Rhein-Main-Donau Gesellschaft, and the Franken Groskraftwerk Gesellschaft, the electrical energy generated at the Kachlet hydro-electric station is to be distributed through the Bayern Co.'s system. In connection with the scheme, the last-named concern will establish at the Kachlet station a transformer plant to step up the current to 110,000 V, at which pressure it will be transmitted to Regensburg, the Bayern Co.'s distributing station. The Bayern Co. has 12 large transformer stations, and is already transmitting current at 110,000 V over 625 miles.

FRANCE.—The establishment of a high-pressure network in Brittany is being brought about by linking existing steam-operated plants at Brest, St. Brieuc, Lorient, St. Nazaire, and Rennes with the large hydro-electric generating station which is being constructed at Guerledan, near Pontivy.

JUGO-SLAVIA—*Commerce Reports* states that in the provinces of Slovenia and Dalmatia a beginning has been made in the utilisation of energy from mountain streams and rivers to generate electricity. The estimated potential water-power resources of the country aggregate 8,949,096 h.p., of which only about 162,000 h.p. has been developed. Serbia is the most important in this respect; here there is a total at average water level of 3,796,974 h.p., of which only 3,880 h.p. has been harnessed. The greatest development has taken place in Slovenia and Dalmatia, where 70,836 and 69,600 h.p. respectively have been developed.

SPAIN.—The new hydro-electric power station on the River Durcal is nearing completion. From the reservoir the water is to be conveyed by a canal about six miles in length to the power station, where two 1,700-kVA turbo-alternators are being installed. The current will be stepped up to 25,000 V for transmission to the Granada-Durcal railway and for the tramways in the province of Granada, and up to 60,000 V for transmission to the town of Almeria.

Dorking.—NEW PLANT.—The Urban District Council has received notice from Edmundson's Electricity Corporation, Ltd., of its intention to carry out extensions at the electricity works. Sanction has been received from the Electricity Commissioners to install two Diesel oil engines with a capacity of 150 kW. The cost of the scheme is £18,600.

Exeter.—LOANS.—The City Council has received the sanction of the Electricity Commissioners to the borrowing of £63,000 for extensions to the electricity works.

In connection with schemes for the relief of unemployment during the winter, it is proposed to apply to the Electricity Commissioners for sanction to the borrowing of £5,000 for the following work:—New h.p. feeder cable from the power station to Mount Pleasant, £2,700; a similar cable from the power station to Exwick, £1,800; transformers and switchgear, £500.

Grays.—LOAN.—The Urban District Council is applying to the Electricity Commissioners for sanction to the borrowing of £4,000 for mains.

Harwich.—LOANS.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £25,500 for the following purposes:—Mains, £19,000; transformers and switchgear, £3,500; meters, £2,250; building work, £750.

Hastings.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. R. F. Ferguson) for the year ended March 31st last record a total income of £55,543, as compared with £51,972 in 1922-23. Working expenses increased by £1,417 to £28,134, leaving a gross profit of £27,409 (£25,255). Capital charges, &c., absorbed £15,364, and there was a net surplus of £12,045, as against a profit of £11,090 in the previous year. During the year £50,916 was spent on capital account, the chief items being £23,433 for machinery and £11,709 for mains, bringing the total expenditure on the undertaking up to £350,273. The electrical energy sold increased from 2,088,120 to 2,791,283 kWh, and the maximum supply demanded rose from 1,360 to 1,730 kW.

Irish Free State.—DUBLIN.—The Dail Eireann has received the report from the Joint Committee on Private Bills that no notice of appeal from the Examiner had been received in the case of the Dublin and District Electricity Supply Bill, which accordingly was deemed to have been read a first time in the Seanad.

SLIGO ELECTRICITY SUPPLY.—The Sligo Bill has passed through its final stages in the Senate. The consulting engineer, Mr. J. C. Elvy, has been instrumental in securing the insertion of a clause enabling the company to enter into agreements with consumers to the effect that a periodical charge shall be made in respect of the maximum power demand in addition to a charge for electrical energy supplied.

Loughborough.—YEAR'S WORKING.—A report presented at a recent meeting of the Town Council showed that the total income for the past year in connection with the electricity undertaking was £34,590, and the expenditure £17,826, leaving a gross profit of £16,764. After providing for interest, sinking fund payments, &c., there remained a net balance of £5,321. The manner of dealing with the profit and the question of the advisability of reducing the charges was deferred.

New Mill (Yorkshire).—LOAN SANCTIONED.—At a recent meeting of the Urban District Council, it was stated that sanction had been received from the Electricity Commissioners to the borrowing of £8,800 for electricity purposes.

Northern Ireland.—NEWCASTLE (CO. DOWN).—The Urban District Council proposes to enter into a contract for a supply of electricity for private lighting at a cost not exceeding 10d. per kWh, and has decided to present the proposal to a joint meeting of the Ratepayers' Association and the Council.

Plymouth.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to borrow £43,640 for the provision of four additional water-tube boilers to replace the obsolete Lancashire boilers at Prince Rock power station. Application is to be made to the Unemployment Grants Committee for a grant towards the cost of the work.

SYSTEM OF SUPPLY.—Application is also to be made to the Electricity Commissioners for consent to alter the system of electricity supply from direct to alternating current. The application is to be made in respect of the whole area of supply, but it is only intended to make the alteration in new supplies which are being made and in the outlying districts of the Devonport area.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CLACTON.—Lighting: First 750 kWh per quarter, 7d. per kWh; next 750 kWh, 6½d. All energy in excess of this amount, 6d. per kWh. Cooking and heating: 1½d. per kWh.

EDINBURGH.—Lighting: From 4d. to 3¾d. per kWh. Heating: A reduction of ¼d. per kWh.

Solihull (Warwickshire).—PROPOSED ELECTRICITY SUPPLY.—The Urban District Council has under consideration the question as to whether it should obtain electricity in bulk from the Birmingham Corporation or request the Corporation to undertake the supply and distribution at the (initial) charge of 7d. per kWh. The Lighting Committee has recommended that the Council should obtain a bulk supply. If the latter adopts this proposal it will have to accommodate an area including Alton, Solihull, Knowle, Shirley, and Dorridge. The electricity would be transmitted underground to five transformer stations to be erected by the Council, and the capital expenditure involved in connection with the scheme would be about £90,000 spread over a period of two years from the commencement of the work. The probable selling price would be 6d. per kWh.

Southend-on-Sea.—PROPOSED HYDRO-ELECTRIC SCHEME.—The Town Council has received a communication from Mr. L. W. Weaver relative to a hydro-electric power plant it is proposed to erect at Mersea, for the purpose of generating electricity by a tidal power system, and as to the terms upon which a bulk supply of electricity could be obtained if such plant were erected. The Council has directed the borough electrical engineer to interview the undertakers of the scheme and report upon the matter.

Special Orders.—The Electricity Commissioners have submitted to the Ministry of Transport for confirmation the following Special Orders made by them:—To the Woking Electric Supply Co., Ltd., for the supply of electricity to certain parishes in the rural district of Staines; the Lancashire Electric Power Co., in the urban district of Golborne; the Western Electric Distributing Corporation, Ltd., in certain parts of the county of Wilts; the Bedford Corporation, in certain districts in the county of Bedford.

Tavistock (Devon).—STREET LIGHTING.—The Urban District Council has accepted the offer of the Tavistock and District Electric Supply Co. for street lighting at £400 per annum for a period of five years commencing from August 14th next.

The Corfino Hydro-Electric Scheme in Tuscany.

An Italian Installation.

THE Corfino is a small tributary of the River Serchio, the second river in importance after the Arno in Tuscany. The Serchio waters the valley of the Garfagnana, which lies between the main chain of the Appenines and the Carrara Mountains. It flows into the sea a few miles north of the Arno, past the industrial centre of Lucca, which, with Leghorn, Pisa, and Massa Carrara, on the one hand, and Florence, Pistoia, and Signa, on the other, forms a chain of prosperous towns continually growing in population and in industrial importance.

The Corfino plant is a small one, but it possesses a number of characteristics which make it worthy of particular notice. It forms part of the great enterprise of the Società di Elettricita Ligure Toscana, founded in 1905 by the brothers Orlando, of Leghorn, and Messrs. Odero, of Genoa, with an initial capital of only 1,000,000 lire (at the time equal to £40,000). The paid-up capital of the company now, however, reaches the total of 100,000,000 lire (£1,000,000 at the present rate of exchange). Working in close collaboration with the Società Elettrica del Valdamo and other minor enterprises, the company supplies the provinces of Lucca, Pisa, Leghorn, and Massa Carrara with electrical energy, and possesses six power stations, namely:

(*a*) The Marzocco thermal plant at Leghorn, having 15,000 b.h.p. installed.

Fig. 1.—Corfino Reservoir.

(*b*) The thermal plant at Pisa, having two horizontal Diesel engines of 1,000 h.p. each.

(*c*) The thermal plant at Lucca, having one Diesel engine of 1,000 h.p.

(*d*) The river Lima hydro-electric plant at Bagni di Lucca, having 8,800 b.h.p. installed.

(*e*) The hydro-electric plant at Gallicano, which utilises the waters of the river Serchio with 22,000 b.h.p. installed and possesses a storage reservoir of 850,000 cubic metres capacity.

(*f*) The Corfino hydro-electric plant, having 6,400 b.h.p. installed, and a reservoir of 800,000 cubic metres capacity.

In addition to the above stations, which provide a total of 55,200 b.h.p. installed, a seventh plant is under construction of Castelnuovo, Garfagnana, also utilising the waters of the river Serchio, which, when completed, will provide another 10,000 b.h.p. and a large storage reservoir of approximately 3,000,000 cubic metres capacity.

The whole of this plant is not only interconnected, but is worked in conjunction with the plant of the Società Elettrica del Valdarno in the Arno valley, which supplies Florence and Pistoia, and with the small experimental plant at Lardarello, which utilises natural steam ejected by geysers in the Province of Siena. Further, an important thermal plant utilising local lignite at Pietrafitta, also in the Province of Siena, is nearing completion (promising an additional 15,000 h.p.), and two further sets of hydro-electric plant are projected in the Serchio valley with immense storage reservoirs of 10 and 15 million cubic metres respectively, capable of completely regulating the very variable *régime* of this river.

The above, taken together with the fact that electrical connection has also been established across the Apenines with the great hydro-electric company of the Adamello to the North (Lombardy) and with the hydro-electric plant at Terni (Umbria) to the South, is typical of the systematic development of hydro-electricity in Italy. Moreover, the whole of the Garfagnana hydro-electric plant, whether constructed, under con

Fig. 2.—The Dam and Pressure Pipe.

Fig. 3.—Power Station and Tail Race.

Fig. 4.—Surge Tower and Pipe Line.

struction, or projected, has been designed according to a regular plan of correlated development by Commendatore Angelo Omodeo, thus ensuring the maximum development of the potentialities of the district with the minimum of expenditure.

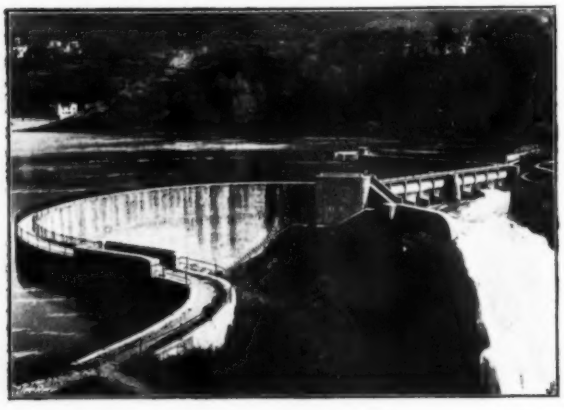


Fig. 5.—The Dam and Spillway.

The electricity is generated at 5,000 volts (3-phase, 50 periods), and is transformed to 33,000 volts for transmission. At a number of sub-stations this voltage is again reduced to 8,600, 7,000, and 5,000 for consumers employing large motors, and to 250 volts for consumers employing smaller motors; for purposes of illumination the voltage is brought down to 150. At the end of 1923 the number of separate consumers, including the Communes which take energy in bulk for public and private lighting, amounted to over 72,000.

Fig. 6.—Corfino Power Station: Turbine Room.

The Corfino plant utilises a catchment area of 25 sq. kilometres, composed, for the most part, of impermeable rock and with a height above sea level varying from 1,667 to 6,334 ft. The area is characterised by woodland, pasture, and bare cliffs. The plant consists of a dam forming an artificial storage reservoir with a capacity of 800,000 cubic metres; a steel conduit 2,500 metres in length and 1.3 metres in diameter, which carries the water under pressure at an inclination of 1/100 to the head of the penstock; a surge tower 186 ft. in height at the junction of the conduit and the penstock; a penstock 700 metres in length and 1.15 metres in diameter; and a power station having two turbo-alternators of 3,200 b.h.p. each, switchgear, safety devices, transformers, and offices.

The maximum amount of water utilisable is 3 cubic metres per second (or, working at extra pressure, 3.3 cubic metres per second). The mean head is 533 ft., and the maximum difference between the level of the lake when full and the level of the tail race is 600 ft. The reservoir would require to have a capacity of 10,000,000 cubic metres, instead of 800,000 only, in order to regularise completely the *régime* of the Corfino, which has a mean annual run-off of 1¼ cubic metres per second. As it is, it is only possible to utilise a mean run-off of 0.45 cubic metre all the year round; but during the eight months of the rainy season (September-April) a mean of 1.4 cubic metres is utilised. The plant is run almost exclusively on a day load and, as it is linked up with the rest of the company's system, full use is made of its possibilities. By working the plant at full capacity during the rainy season part of the company's group of thermal stations may be shut down, and the height above sea level of the Corfino reservoir, small as it is, contributes to the elasticity of the other hydro-electric plant situated below it.

The dam is 128.5 ft. in height, excluding the foundations; 7 metres thick at the base and 1½ metres thick at its crest. It is constructed in the form of an arched bay, vertical on its concave face, where the pressure is taken. It is made of reinforced concrete with an impermeable apron, 2½ cm. thick, on the water side. To the right of the bay are situated the devices for discharging the flood water. They consist of five automatic valve siphons, on the one hand, capable of dealing with a discharge of 35 cubic metres per second; and of five sluices operated mechanically, capable of dealing with a further discharge of 55 cubic metres per second. This allows for a total discharge equal to 3.6 litres per square kilometre of catchment area, but on account of the extremely variable run-off, which, on days of heavy rain, amounts to 35 cubic metres per

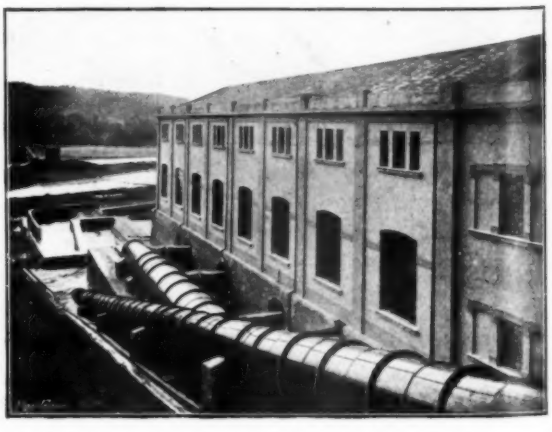


Fig. 7.—Serchio Power Station: Discharge Pipe and Distributor

second, this large allowance has been considered justified.

A problem which caused some anxiety to the engineers, given the smallness of the reservoir, the impossibility of emptying it without curtailing the production of energy, and the torrential run-off during certain periods in the year from an area only partially wooded, was the danger of the lake rapidly silting up with the deposits brought down in times of flood. The solution adopted is ingenious, and has proved extremely satisfactory. About 200 yards above the dam the old river bed, before the construction of the reservoir, made a hair-pin bend, beyond which the river came down in a straight line. A series of steel wire cages has accordingly been placed across the old river bed immediately below the bend, and a tunnel has been constructed carrying on the straight line of river above the bend and joining this point with the river below the dam. The tunnel is closed by a lock-gate worked by a piston. At certain times during the rainy season, when the run-off is particularly abundant (since, owing to the smallness of the reservoir, a certain quantity of water must necessarily run to waste), the level of the reservoir is allowed to fall to that of the entrance of the tunnel. The lock-gate is thereupon raised for several days at a time, and as the steepness of the tunnel carries the water at the rate of 6.5 cubic metres per second, the *débris* that has collected above the cages during the periods when the gate was shut is thus carried with it into the constant stream below the dam.

The two turbo-alternators, which have horizontal shafts, were made by Messrs. Rivaiolo Ligure; so also were the 33,000-V transformers. The switchgear and safety devices are for the most part by Messrs. Magrini, Ltd. A double transmission line (six wires) carried overhead on steel and reinforced-concrete lattice poles leaves the power station from the top and follows the river valley till it joins the Castelnuovo power station, on the River Serchio, at the present time nearing completion. It is not until the large power station still further down at Gallicano is reached that the two branches of the double transmission line diverge, forming in the remainder of its extent a wide circle.

Electricity Supply at Lancaster.

The New Generating Station.

LANCASTER initiated a public supply of electricity just 30 years ago. A generating station of 240-kW capacity was established on a site adjoining the Lancaster and Preston canal, and met the needs of the time till the tramways were contemplated in 1901, when the capacity of the Marton Street station was increased to 440 kW. Simultaneously a new generating station with a capacity of 1,000 kW was erected alongside the original one, and the pressure was also increased from 110 to 230 volts for lighting, and from 220 to 460 volts for power.

By 1914 the original plant was fully utilised, but the war checked progress for five years, Major G. C. Milnes, M.C., M.I.E.E., electrical engineer, being on active service. Peace brought a renewed demand, and the undertaking was faced with the problem of making up five years' arrears of maintenance at increased cost; prices were raised, and eventually the budget was balanced, and the greater part of the money provided in the lean years from the rates to balance the deficits has been repaid.

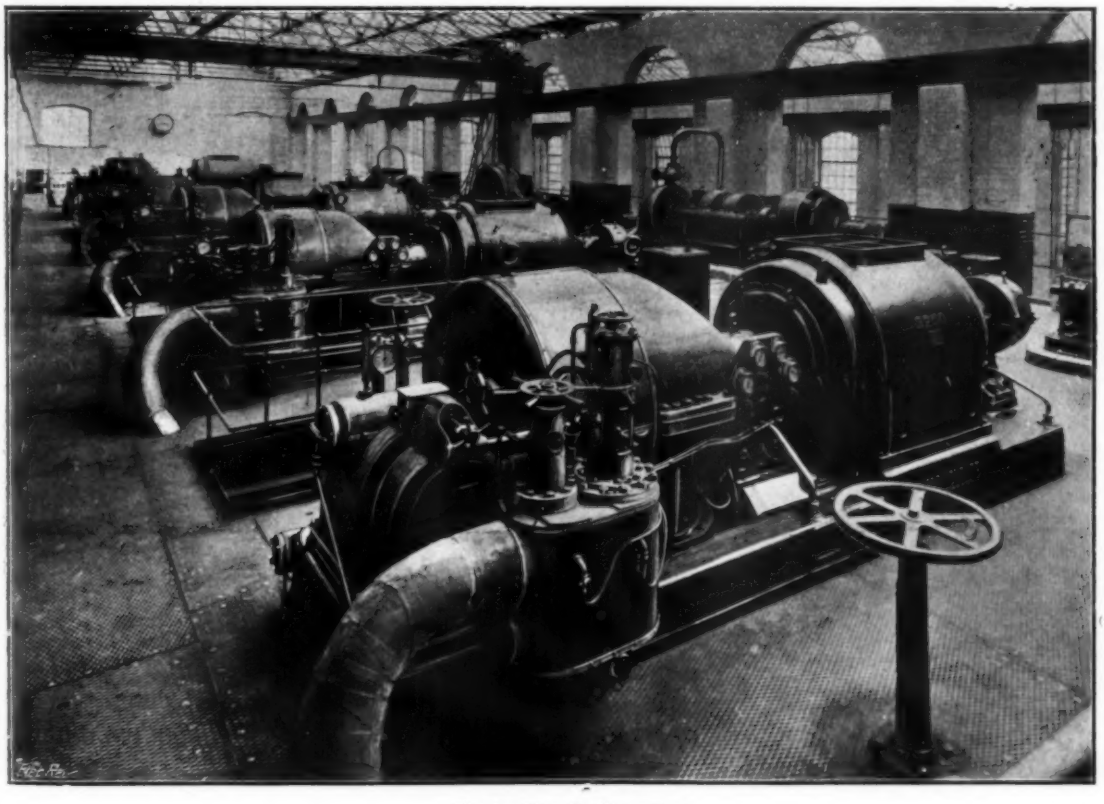


Fig. 1.—The Turbine Room.

Since March, 1919, nearly £18,000 has been spent

out of revenue on the repair and renewal of the mains, and a further £4,000 on new mains and services.

In 1920 the Electricity Commissioners delimited the

Fig. 2.—The New Lancaster Generating Station.

North Lancashire and South Cumberland Electricity District and in February, 1922, they held an inquiry into the reorganisation of the supply in the area. The official scheme of reorganisation was not approved by the Boroughs of Lancaster and Morecambe which, with the

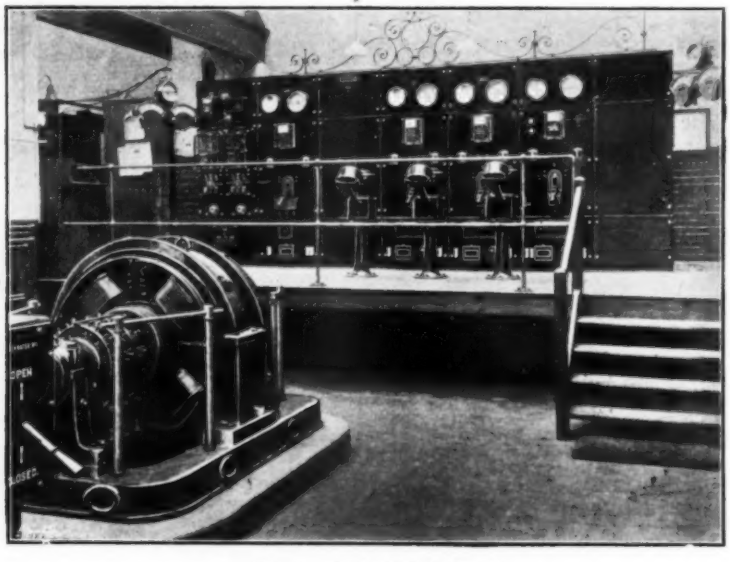


Fig. 3.—The Main Switchboard.

approval of the Urban District Councils of Carnforth and Heysham, and the Rural Districts of Lancaster and Lunesdale, decided to submit an alternative scheme, which was prepared by Major Milnes, and was accepted by the Electricity Commissioners. The Lancaster Corporation agreed to establish a generating station, and provide electricity wherever a demand was shown to exist, and the final scheme was presented to the Town Council in January, 1923.

The Corporation purchased from the Government the power station erected on the River Lune, off Caton Road, to supply the National Projectile Factory. The site lies on the L.M. & S. main line from Yorkshire to Heysham Harbour. It includes a frontage to the River Lune, from which sufficient water for all purposes can be obtained for a station with five times the present capacity of the new works, *i.e.*, 3,000 kW; a private railway siding gives access to the Lancashire and Yorkshire coalfields.

Fig. 2 is an exterior view of the station, while fig. 1 illustrates the turbo-generator room. The new plant consists of three Metropolitan-Vickers 1,000-kW, 0.8 p.f., 6,600-V, 50-cycle, 3,000-r.p.m. sets capable of carrying an overload of 25 per cent. They are provided with Le Blanc multiple-jet condensers and Sturtevant air filters.

Each of the Stirling water-tube boilers is fitted with Babcock & Wilcox chain-grate stokers, superheaters, a Green 320-tube economiser, and a Sirocco induced-draught fan. The boilers have been erected in pairs, with one steel chimney for each pair, and each boiler is capable of providing 30,000 lb. of steam per hour, at a pressure of 200 lb. per sq. in., and superheated 200 deg. F.

Each is provided with an overhead coal bunker to hold 50 tons; the coal is received by rail, dumped into the motor-driven worm conveyor hopper beneath the track, thence into a rotating bucket filler, and carried by a chain and bucket elevator into the coal bunkers. Upon a large storage ground between the power station and the railway a reserve of 1,000 tons of coal is being accumulated. The fuel-handling plant was supplied by Messrs. Babcock & Wilcox, Ltd.

The boiler feed water is provided by three Weir turbine-driven pumps, one of which has a capacity of 40,000 lb. per hour, that of each of the other two being 120,000 lb. The exhaust steam from the pumps is used to heat the feed water. The three hotwell pumps are of the 4-in. Drysdale centrifugal type, each driven by a 4-h.p. motor. A rotary water screening plant has been erected on the river side, and a Paterson boiler feed-water softener has been provided.

The main e.h.p. switchgear, fig. 3, was supplied by the Metropolitan-Vickers Electrical Co., Ltd., and consists of four machine and two auxiliary plant cubicles. The generators are protected on the Merz-Price system, and automatic field-"killing" switches and M.-V. voltage regulators are provided. One running machine is earthed through a resistance. The e.h.p. feeder switchboard was supplied by Messrs. Ferguson, Pailin, Ltd., and consists of six cubicles, each equipped with a direct-acting lever gear-operated oil switch and Merz-Beard protective gear.

All the station auxiliaries are driven by 440-V d.c., which is provided by either a 150-kW rotary fed from the main bus-bars, or by one of two 225-kW, or one 100-kW Greenwood & Batley-De Laval steam turbine-driven geared d.c. generators. These sets were transferred from the Marton Street station; the 100-kW machine can be run non-condensing, while the others are coupled to a surface condenser.

The electrical plant originally installed by the Government was unsuitable for the purpose of a public supply, and has been entirely replaced by the Corporation,

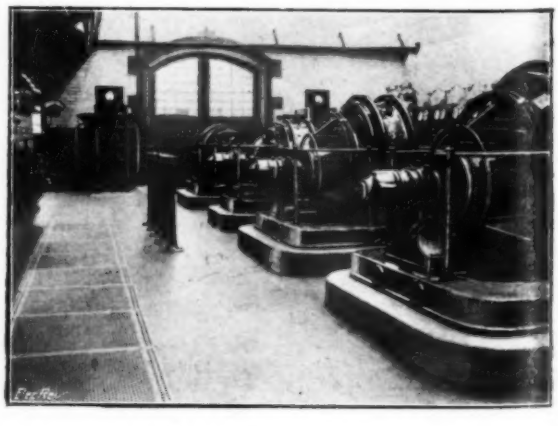


Fig. 4.—The Main Sub-station.

and the capacity of the plant will probably be increased to 5,000 kW within the next few months.

The supply in bulk to the Morecambe Corporation was commenced during September, 1923, and in October

the old generating station at Marton Street commenced to operate as a sub-station, fig. 4, taking a 3-phase supply from Caton Road at 6,600 volts, and converting it to d.c. for distribution throughout the town and also furnishing a.c. to the static sub-stations. The plant consists of two 400-kW and three 250-kW Metropolitan-Vickers rotary converters with 10 truck-type Ferguson, Pailin switchboard panels. Ample room exists for extension, but as the town supply (except in the centre) is being changed from d.c. 3-wire to a.c. 3-phase, 4-wire, the plant will probably suffice. One rotary sub-station has been installed on a consumer's premises, and three static sub-stations are in course of erection, each housing two 250-kVA Ferranti transformers with Reyrolle h.p. and l.p. switchgear. A ring main is being laid to supply these sub-stations, two more of which are projected, and duplicate feeders have been laid from the Caton Road generating station to the Marton Street main sub-station, through which the a.c., e.h.p. supply passes. There are some 13,600 yd. of e.h.p. cables in Lancaster, including the bulk supply feeders, and when the present programme of equipment of the Caton Road generating station is complete (5,000 kW), it will have cost between £55,000 and £60,000.

The formal inaugural ceremony of the Caton Road station was performed on June 26th, when Mr. F. Mockett (power station superintendent), on behalf of the staff, presented Major G. C. Milnes, engineer, with a Waltham gold watch, suitably inscribed, as a token of appreciation of their chief. A luncheon at the Town Hall was presided over by the Mayor; Councillor R. Roberts, Chairman of the Electricity Committee, proposed the toast of "The Electricity Supply Industry," and Sir John Snell, in reply, said that only a few weeks previously he had been asked by the Government if he could assist it with definite and practical proposals for the supply of electricity in rural districts. He had recently been informed by a progressive farmer that he would rejoice at the prospect of electrical supply for his machinery and dairy work, as it would be a veritable godsend.

Tramway and Railway Notes.

Continental.—CZECHO-SLOVAKIA.—A revised scheme for the electrification of the railways has been submitted to the Ministerial Council, with a view to its being taken in hand at the beginning of next year. The electrification will be carried out in stages and completed within 10 years, next year's budget proposals being for an outlay of 15,000,000 crowns. The second stage contemplates the electrification of the line from Prague to Pilsen, and will involve a total outlay of 66,000,000 crowns. This conversion will take two years to complete. For the works for the year 1926, 36,000,000 crowns are allotted, and for 1927, 30,000,000 crowns. The electrical energy will be provided principally by two hydro-electric power stations in Middle Bohemia not yet constructed—one at Wran and another at Stechowitz.

SPAIN.—The construction of the new underground railway, Puerta del Sol to Ventas, Madrid, which was commenced by the Compañia Metropolitano Alfonso XIII two years ago, has been completed, and it was inaugurated on June 16th. The new line is nearly 2¼ miles in length, and the total length of the underground railway now in operation is over seven miles. The company is to construct a new line which will connect Puerta del Sol with Glorieta de Quevedo, and work will shortly be put in hand for the construction of branch lines from Isabel II to the North Station, and from Calle Alcala and Calle Goya to the Paseo Rosales.

Southport.—YEAR'S WORKING.—The report for the year ended March 31st last of the manager of the municipal tramways (Mr. T. J. Kendrew) has come to hand. This shows that the total revenue was £70,841, as compared with £78,032 in 1922-23. Working expenses were lower by £2,628 at £48,703, leaving a gross profit of £22,138 (£26,700), to which was added a balance brought forward from the previous year of £4,037 and bank interest of £166, making a total of £26,341. This was disposed of as follows:—Interest and dividends, £3,709; sinking fund, £4,662; income tax, £4,792; renewal fund, £10,000; balance carried forward, £3,178. The expenditure on track renewals during the year amounted to £13,216. The number of passengers carried was 9,678,926, an increase of 375,917, and the car-miles run increased from 841,871 to 873,110. In March last work was commenced on the extension of the tramway track in Cemetery Road to Liverpool Road and Bedford Road.

Walsall.—YEAR'S WORKING.—The revenue account of the county borough tramway undertaking (general manager, Mr. C. Burgess) for the year ended March 31st last shows a total income of £76,524, as compared with £78,908 in the previous year. Working expenses were slightly lower at £57,378 (£58,735), leaving a gross surplus of £19,146, as against £20,173. Capital charges absorbed £13,904, and there was a net profit of £5,242, as compared with a surplus of £5,952 in 1922-23. This, together with net profits of £3,760 from the motor services and £157 from the carriage of parcels, was carried to appropriation account, from which £1,501 was contributed to rate relief; a balance of £15,860 was carried forward. The number of passengers carried increased from 10,079,666 to 10,744,392, and the net car-mileage from 866,443 to 901,580.

Wolverhampton.—YEAR'S WORKING—The report on the working of the Corporation tramway undertaking (general manager, Mr. C. O. Silvers) for the year ended March 31st last records a total income of £102,449, as compared with £109,725 in 1922-23. Working costs amounted to £73,189, as against £78,267, leaving a gross surplus of £29,260 (£31,458), to which was added bank interest of £781, and a contribution of £440 towards capital charges from the Wolverhampton and District Electric Tramways, Ltd., in respect of through-running agreement, making a total of £30,481. Capital charges absorbed £21,339, and there was a net profit of £9,143, as compared with a surplus of £10,777 in the previous year.

The railless-car service on the Wednesfield route, which was commenced in October, 1923, recorded a total revenue to March 31st last of £6,239. Against this working expenses (£4,140) and capital charges (£1,355) were charged, leaving a net surplus of £744.

The number of passengers carried on the two systems was 15,745,680 (railless cars, 874,802), and the number of car-miles run was 1,306,954 (railless cars, 93,406).

Telegraph and Telephone Notes.

Australia.—NEW SYDNEY EXCHANGES.—The *Electrical Engineer of Australia and New Zealand* states that two new exchanges are to be provided in the Sydney telephone network. One, in Castlereagh Street, will be known as City South, and the other, in Liverpool Street, City East. Contracts have been let for the supply of telephone equipment, which will be of the automatic type and will comprise all the latest improvements. The plant to be installed at City South will make immediate provision for 7,250 subscribers' lines, which can be extended to an ultimate figure of 20,000 lines. At City East the equipment will accommodate at the outset 4,440 lines and will be capable of extension to 10,000. The total cost of these new exchanges will amount to more than £400,000. On completion the whole of the manually-operated telephones in the city area proper will be converted to automatic working. It is anticipated that the plant will be brought into operation in from 18 months to two years hence.

Austria.—OPERATORS' STRIKE.—The Vienna correspondent of *The Times* reported on July 18th that the telephone and telegraph operators in the city ceased work for several hours as a protest against their treatment in the "Government Servants' Remuneration Bill." Efforts were being made to obtain better conditions, and in the event of non-success it was proposed to call a further strike, aided by the railwaymen.

Czecho-Slovakia.—NEW STATIONS.—A radio transmitting station of 5 kW capacity has been opened at Kaschau by the Postal Department. A similar station is to be established at Pressburg, and a 1-kW station at Ungvar.

Three new radio stations are to be erected by the Ministry of Posts and Telegraphs. These will be situated at Kosice (Slovakia), Bratislava (Slovakia), and Uzhorod (Carpathian Ruthenia).

It is proposed to hold a wireless exhibition in Brunn in August of the current year. It will be open to foreign firms wishing to display their exhibits.

German-Spanish Submarine Cable.—The German Atlantic Telegraph Co., of Cologne, has been authorised by the Spanish Government to connect up a submarine cable which will give direct telegraphic communication between Vigo and Emden.

Greenland.—NEW RADIO STATIONS.—The Danish Radio Co. has received a contract from the Danish Government for the erection of four radio transmitting stations in Greenland. A station at Julianshaab will be equipped with a 5-kW arc transmitter, while stations at Godhaven, Godthaab, and Angmagsalik will each have .5-kW transmitters. The Julianshaab station will maintain communication with the Reykjavik (Iceland) and other European stations. Only Danish labour and materials are to be employed.

Irish Free State.—TELEPHONE CAPITAL BILL.—In the Free State Senate last week, on the committee stage of the Telephone Capital Bill, 1924, Senator Douglas suggested that an undertaking should be set up in Ireland for the manufacture

of telephone instruments. Sir John Keane advocated a system of rural telephones, and Colonel Moore supported this proposal. President Cosgrave said that they had expended something like £6,450 for this purpose in the year 1922-23, and £70,000 for the year 1923-24. That left out of the amount now provided a sum of, roughly, £36,000, available for the extensions up to March 31st, 1926. Development through the country depended on the number of subscribers in a particular area. The Minister was limited to the extent that any capital expenditure must have a return from other sources to make it an economic undertaking. The Bill passed through committee.

Imperial Radio Communication.—THE "BEAM" SYSTEM.—It is reported that the Government has consented to the erection of a "beam" station in this country for the purpose of establishing communication with a similar station in Australia. The *Daily Telegraph* Parliamentary correspondent stated last week that it was probable that the Marconi Co. would be given a licence to erect the station and operate it for a period, after which it would be taken over by the Government.

Long-distance Telephony.—Nineteen countries were represented at the meeting of the International Long-Distance Telephony Consultative Committee recently held in Paris, when it was decided to form a permanent commission to further the establishment of long-distance telephonic communication throughout Europe. The headquarters of the commission will be in Paris, and will, it is hoped, form a centre where all information regarding long-distance telephony will be collated and made available to the authorities in all the principal European countries.

Radio Direction-Finders.—STEADY PROGRESS.—The installation of radio direction-finders on vessels of the Mercantile Marine is proceeding at a steady rate. The Radio Communication Co., Ltd., has recently completed the equipment of 17 large ships, and four other installations are in progress.

Switzerland.—NEW RECEIVING STATION.—The St. Gall Radio Association has decided to construct a wireless receiving station at the Saentis Observatory, which is 8,300 ft. above sea level.—*Reuter* (Berne).

Radio Notes.

A Broadcasting Feat.—DIRECT TRANSMISSION.—On Monday last a programme was broadcast from Chelmsford by the B.B.C. with the 1,600-m. wave-length, and was received by the local stations and relayed therefrom, without the use of land lines. Except at London, Cardiff, and Newcastle, which reported atmospheric interference, excellent results were recorded throughout Great Britain.

Amateurs and the Prohibition of Foreign Transmission.—The Radio Society of Great Britain is in touch with the Postmaster-General regarding the restrictions as regards transmission to the Dominions and foreign countries recently introduced into the experimental transmitting licences now being issued. It is hoped that an official announcement may be made at an early date.

A Radio Fair.—The "First Radio World's Fair" is to be held at New York from September 22nd to 28th. Among the inventions to be shown will be at least three instruments designed for the purpose of "radiocasting" photographs in motion, and it is stated that half-a-dozen recognised wireless engineers are trying to perfect systems for transmitting pictures. A number of the leading radio trade organisations are planning to hold their 1924 conventions in New York during the Fair, and fully a thousand jobbers and dealers, native and foreign, are expected to attend the show. The International Amateur Builders' Contest is assuming such huge proportions that the management expects this feature alone to fill the entire basement of Madison Square Garden; entries are already coming in from all parts of the world. Twenty-five prizes will be awarded in this interesting contest. Entry forms with full particulars will be supplied to all who write direct to the General Manager, Mr. James F. Kerr, Hotel Prince George, New York City.

Chile.—BROADCASTING ARRANGEMENTS.—Arrangements are being carried out in Chile for a radio broadcasting system to embrace every town and city in the country. The syndicate known as Radio Chileno plans to erect two new stations, one in the south of the country at Temuco and the other at Antofagasta, in the nitrate zone. The principal station at Santiago has been in operation for some eight months, but in view of the unsatisfactory results obtained with the present equipment the station will be dismantled and re-equipped with modern American apparatus of the same type and power as that purchased for the new plants. During the change-over a 10-W American transmitting set will be used to broadcast programmes.—*Commerce Reports.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—July 29th. Royal Mental Hospital. Electric lighting installation, &c. Messrs. Kelly & Nicoll, architects, 367, Union Street, Aberdeen.

Aldershot.—July 29th. Electricity department. 350 yd. .1 and 330 yd. .06 four-core l.p. cable. (See this issue.)

Argentina.—BUENOS AIRES.—October 16th. Argentine National Sanitation Works Department. Hydro-electric plant for Mendoza, including turbines, 3-phase, a.c. generators, switchboard, &c.*

Australia.—SYDNEY.—October 15th. New South Wales Government Railways and Tramways Department. 20,000-kW turbo-alternator for White Bay.*

August 11th. Public Works Department. 66,000-V insulators for the Barren Jack hydro-electric scheme.*

September 15th. Postmaster-General's Department. Motor generator sets.*

MELBOURNE.—August 27th. Victorian Railways. 7-ton electric travelling crane, 3-motor type, complete with electric lifting magnets and equipment.—*Reuter's Trade Service* (Melbourne).

September 9th. Postmaster-General's Department. Switchboard cords.*

Aylesbury.—Electricity Department. Erection of 11,000-V .05 sq. in. overhead transmission line. (July 18th.)

Barnstaple.—August 1st. Secretary, West Buckland School. Complete electric lighting installation at the school. (See this issue.)

Bedford.—August 11th. Electricity Department. Water-tube boiler, stoker, draught plant and accessories. (July 18th.)

Belfast.—August 18th. Electricity Department. Motor generator and transformers. (See this issue.)

Belgium.—BRUSSELS.—August 6th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Telephone cable, &c., at Lierre, Boom, and Cappellen. Particulars (Cahier des Charges Special No. 3-35) for 4 fr. 60 c.

Birmingham.—August 30th. Salvage and Stables Committee. Plant for refuse disposal and salvage works. Two 100-kW generators, with condenser and control panels, h.p., 3-phase transformer, rotary converter and control panel, distribution panel and fuse boxes, 3-wire balancer, two 5-wire balancer sets, with switchgear, &c., baling presses, &c. (See this issue.)

Cleckheaton.—August 1st. Hospital Board. Electric lighting installation at North Bierley Joint Hospital, Oakenshaw Lane. Specifications from Mr. W. H. Clough, clerk to the Hospital Board, 1, Northgate, Cleckheaton.

Dublin.—August 9th. Electricity Department. Transformers and single-phase, three-phase, and slot meters for 12 months. (See this issue.)

Glasgow.—August 2nd. Health Department. Electric lighting, &c., at pavilions at Bellefield Sanatorium. Particulars from Public Works Department, City Chambers.

Harrogate.—August 9th. Electricity Department. One 3,000-kW turbo-generator. (July 18th.)

Heywood.—August 7th. Electricity Department. E.h.p. and l.p. cables. (See this issue.)

London.—GREENWICH, S.E.—July 31st. Board of Guardians. Electric lighting installation at the Greenwich and Deptford Hospital. (July 18th.)

MILE END, E.—July 31st. Board of Guardians. Six months' supply of electrical fittings. Mr. T. Rowland, clerk to the Guardians, Bancroft Road, Mile End, E.1.

Looe.—August 16th. Urban District Council. Supply of electricity in the district. (See this issue.)

Manchester.—August 12th. Tramways Committee. Permanent-way special track work. Mr. Henry Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly, Manchester.

Newton-in-Makerfield.—July 28th. Electricity Committee. E.h.p. and l.p. switchgear, e.h.p. and l.p. cables, rotary converter equipments, and static transformers. (July 11th.)

New Zealand.—WELLINGTON.—September 2nd. Public Works Department. Transformers and 11,000-V switchgear and metering apparatus for the Mangahao power scheme.*

Portsmouth.—August 5th. Tramways Committee. Stores, &c., for 12 months, including insulating materials, lamps, overhead line materials, &c. (July 18th.)

Rochdale.—July 30th. Electric lighting installation at Facit Conservative Club. Mr. H. Cansell, secretary.

Sligo.—July 30th. Sligo Lighting and Electric Power Co. Electric lighting and power equipment, including buildings, crane, gas producer plant, water-cooling apparatus, alternators, cables, &c. (July 18th.)

Southampton.—August 26th. Electricity Works. Two water-tube boilers, complete with superheaters, chain-grate stokers, economisers, mountings, &c., induced-draught fans, and steel chimney, &c., steam, feed-water, and other piping, &c. (See this issue.)

South Africa.—JOHANNESBURG.—August 23rd. Municipal Council. 42 current transformers.*

Spain.—MADRID.—August 15th. The Spanish Ministry of Public Works (Direccion General de Obras Publicas) in Madrid are inviting tenders. Establishment and equipment of a hydro-electric generating station at Agueda (Province of Salamanca).

Uruguay.—MONTEVIDEO.—September 10th. State Electricity Department. Insulators, &c.*
September 15th. 37,750 iron supports for aerial wires.*
State electricity works. September 23rd. 60,000 metallic and carbon filled filament lamps.*

Warrington.—August 5th. Electricity and Tramways Committee. Extension e.h.p. main switchboard and sub-station truck switchgear. (July 11th.)

Woodhouse.—July 30th. West Riding Education Committee. Electric lighting installation at Woodhouse Secondary School. Specifications from Education Department, County Hall, Wakefield.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Ayr.—Tramways Committee. Accepted:—
New rails (£2,764).—Bolckow, Vaughan & Co.
Burgh Council.
Electric lighting installation in connection with the reconstruction of Ayr slaughter-house (£303).—William Auld & Sons.

Belgium.—The Belgian Post and Telegraph authorities in Brussels last week opened tenders for the supply of 40 lots of miscellaneous telephone material. The contracts for the majority of the lots were divided between the New Antwerp Telephone and Electrical Works and the Bell Telephone Manufacturing Co., of Antwerp.

Colombia. — CARTAGENA. — Cartagena Waterworks, Ltd. Accepted :—
House-service fuses for the electric supply.—Midland Electric Manufacturing Co., Ltd.

Exeter.—City Council. Accepted:—
One 1,500-kW turbo-alternator (£10,090).—Brush Electrical Engineering Co., Ltd.

Kilmarnock.—Town Council. Accepted:—
Electric lighting work (£105).—William Johnstone & Sons.

London.—LONDON COUNTY COUNCIL.—Highways Committee Coal-handling plant for the west storage bunker at Greenwich power station :—

Henry Simon, Ltd. (Accepted.)	**£7,844**
R. Dempster & Sons, Ltd.	7,924
Stothert & Pitt, Ltd.	8,225
Spencer (Melksham), Ltd.	8,929
W. J. Jenkins & Co., Ltd.	8,960
Mitchell Conveyor and Transporter Co., Ltd.	8,980
Rownson, Drew & Clydesdale, Ltd.	9,152
Hepburn Conveyor Co., Ltd.	9,516
Paterson Hughes Engineering Co., Ltd.	9,598
Naylor Bros., Ltd.	9,727
New Conveyor Co., Ltd.	10,003
Babcock & Wilcox, Ltd.	10,884
Barry, Henry & Cook, Ltd.	10,997
Fraser & Chalmer's Engineering Works	11,091
E. Bennis & Co., Ltd.	11,894
The Coppée Co. (Great Britain), Ltd.	14,704
Geo. Robson & Co.	16,300
General manager's estimate	9,500

Radcliffe (Lancs.).—District Council. Accepted :—
750-kW rotary-converter (£3,193); e.h.p. and h.p. switchgear (£970).—British-Thomson Houston Co., Ltd., Rugby.

South Africa.—JOHANNESBURG.—Municipal Council. Accepted :—
10,000-kW set.—Metropolitan-Vickers Electrical Co., Ltd.
Condenser.—W. H. Allen, Sons & Co. (The total cost of the contracts is £32,657).—*Reuter's Trade Service* (Johannesburg).

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names of makers or suppliers of :—

FAMA wireless valves.
MEGORINE insulation.

Notes.

The British Cast-Iron Research Association.—A further stage in the development of the Cast Iron Research Association was reached a few days ago, when the Association formally took possession of its laboratories. These are situated in Guidford Street, Birmingham, and are equipped for the conduct of chemical analyses and general metallurgical and heat-treatment work. The capacity of the Association to deal with its work will be greatly increased, but it is not intended to abandon the policy of having investigations conducted in prominent University laboratories and in the works of members. It is anticipated that the Association, which commenced a new financial year on July 1st, will incur an expenditure during the year of between £6,000 and £7,000. The research programme includes important investigations on erosion- and corrosion-resisting cast irons; moulding sands; graphitisation; heat-resisting cast iron; the production of malleable cast iron; cupola practice; cast irons for electrical and magnetic purposes; measurement of melting and pouring temperatures; the fundamental properties of cast iron; standardisation of test bars, materials and methods; facing sands and blackings; cast iron to resist abrasive wear; and, jointly with the British Motor and Allied Manufacturers' Research Association, automobile cylinders and pistons.

British Standard Specifications.—The British Engineering Standards Association has issued two further Specifications. The first (No. 5,027—1924) gives standard dimensions for magnetos for i.c. engines, covering four types. The dimensions standardised are those which affect the interchangeability of magnetos as a whole. Recommendations are also made with regard to the width of the engine coupling, flange mounting, and the sparking position in relation to the keyway in the tapered end of the armature spindle. Full particulars are given for the plug and ring gauges for checking the taper in the magneto coupling and on the armature spindle.

The other Specification (No. 204—1924) is a list of terms and definitions used in conection with telegraphs and telephones. This will eventually form a section of the glossary of electrical engineering terms which the Association has in contemplation. The list has been drawn up in co-operation with the American Institute of Electrical Engineers and the American Engineering Standards Committees, thus ensuring uniformity in nomenclature as far as possible among telegraph and telephone engineers in this country and America. About 230 definitions are included in the list, and terms used in connection with automatic telephony are among them; the latter were previously contained in a separate Specification.

The new publications can be obtained from the Association's Publication Department, 28, Victoria Street, S.W.1, at the price of 1s. net each (1s. 2d. post free).

Appointments Vacant.—Instructors in practical mathematics and electrical and mechanical engineering for the East Ham Technical College. Two assistant mains engineers (450 taels per month), one senior assistant sub-station engineer (400 taels per month), and two meter-testing assistants (300 taels per month) (tael=3s.) for the Shanghai Municipal Electricity Department. Consumers' engineer (£407) for the Southampton Corporation Electricity Works. Junior technical assistant (£176+bonus=£279) for electrical experimental work at the Royal Aircraft Establishment, South Farnborough. Plumber-jointer for the Walthamstow Urban District Council Electricity Department. Jointer for Llandudno Electricity Works. (See our advertisement pages to-day.)

The World Power Conference.—THE SOCIAL SIDE.—Before leaving England, the oversea visitors to the World Power Conference passed a formal resolution expressing, in warm terms, their appreciation of the hospitality extended to them while they were here, and a short account of the principal functions to which they were referring may be of interest. They began on June 30th with the reception of the delegates at Wembley by His Royal Highness the Prince of Wales, followed in the evening by a banquet given at Queen's Hall, where Lord Derby presided over a gathering of nearly 800 persons. On July 2nd the chief delegates attended a dinner given at Lancaster House by His Majesty's Government, and presided over by Mr. Clynes. On July 3rd a dinner was given to the delegates by the U.S. National Committee at the Hotel Cecil, when Mr. Merrill, Chairman of the U.S. Executive Committee, was in the chair. On the next day the Canadian National Committee gave a luncheon to the delegates at the Hotel Victoria, when Mr. Dunlop gave an account of the inception and growth of the idea of a world conference on power. The High Commissioner, Sir Peter Larkin, was in the chair. On July 5th, the Delegates attended His Majesty's Garden Party at Buckingham Palace. On the 8th the Swedish National Committee gave a luncheon to the delegates at Wembley, which was followed in the evening by a conversazione given by the Italian National Committee. On the evening of the 9th there was a conversazione by the Institution of Civil Engineers, and, on the 10th, a luncheon by the Institution of Electrical Engineers and a conversazione by the Royal Society. On July 11th the Kelvin Centenary banquet was given at the Connaught Rooms, with Lord Balfour in the chair, and on Saturday, July 12th, the festivities were brought to a close with a dinner to several of those who were prominent in organising the Conference, given at the Japanese Embassy in native Japanese style and with due ceremonial.

The International Electrotechnical Commission.—The "I.E.C.," as it is called, has been referred to many times during the World Power Conference and the Kelvin Centenary Celebrations, but outside a very limited number of electrical engineers and manufacturers, who give their time and experience freely to this international work, few people realise either the extent of its rôle or the importance of the work it is accomplishing. It was formed in 1906, with Lord Kelvin as its first president. Signor Guido Semenza, who has taken a leading part both in the World Power Conference and in the Kelvin Celebrations, is its present president. Since the war several international advisory committees have been appointed to study various subjects of importance to the economical development of the electrical industry in different countries, and meetings have been held in Paris, Brussels, Geneva, and London. A Council meeting was also held in Paris in December, 1923, at which ten different countries were represented, and at which Dr. C. O. Mailloux, of New York, the retiring president, was appointed honorary president. Dr. Mailloux for 18 years has given unstintingly of his very best to encourage and to help forward the good work. He has crossed the ocean many times, when he might have been otherwise engaged in his professional duties, in order that the officers of the I.E.C. might have the benefit of his long experience, and the assistance of his great linguistic attainments.

The Commission may be described as a world parliament of electricians; 27 nations now join in the work and financially support it. In this country the British National Committee of the I.E.C. is under the ægis of the British Engineering Standards Association. Similarly, in most other countries, the National Committee is affiliated with the National Standardising body, and in this way any overlapping of effort is avoided.

The influence of the Commission is being increasingly felt in industrial matters, and if, through the assistance of the recently-appointed Committee of Action, a successful solution of the important problems at present before it is reached, a great deal will have been done towards simplifying international relations in electrical matters and establishing an equitable basis for the comparison of tenders for electrical machinery coming from different parts of the world. This, of course, will be of inestimable value to our export trade. The question of the rating of electrical machinery is, however, full of complexities. It is one in which the technical side is, comparatively speaking, of less importance than the commercial side, and to establish an international basis for the testing and reception of electrical machinery implies a coming-together of the manufacturers of the different countries to agree upon some conventional means of comparing tenders, which is not an easy matter. The I.E.C. is working along the broadest lines, and is endeavouring to be as truly international as possible, and wherever possible to consider political questions as entirely outside its sphere of action.

Meetings of five international advisory committees were held in London last week. They dealt with the rating of electrical machinery, graphical symbols, traction motors, transformer oils, and, last, with terms and definitions. Amongst the 30 delegates who have attended the meetings as representative of the 12 national electrotechnical committees appointing delegates to the Advisory Committees are Signor Guido Semenza, president of the I.E.C.; Dr. C. O. Mailloux, the hon. president; Sir Richard Glazebrook, K.C.B., president of the British National Committee; Prof. Feldmann, Dr. Clayton Sharp, Mr. E. Huber Stockar, and Prof. Lombardi, presidents respectively of the Dutch, American, Swiss, and Italian National Committees.

A Large Electrically-propelled Ship.—The *Journal of Commerce* states that the largest electrically-propelled passenger ship in the world is in course of construction for the Matson Line of San Francisco. The equipment will consist of two Curtis steam turbines directly connected to two 12,000-h.p., a.c. generators, which will supply electricity to two 10,000-h.p. synchronous motors, each connected with a propeller shaft. Plans for the new liner call for a speed of 21 knots, which will enable the vessel to make a round trip between San Francisco and Honolulu every 14 days, including two and a-half days in each port. This compares with the present schedule of 28 days.

Educational.—UNIVERSITY COLLEGE OF SWANSEA, APPLIED SCIENCE DEPARTMENTS.—Courses of study are provided for the B.Sc. degree of the University of Wales and for diplomas of the College in civil, mechanical and electrical engineering and metallurgy. Entrance scholarships will be offered for competition in September, 1924. Particulars may be obtained from the Registrar, Singleton Park, Swansea.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—Diplomas in electrical engineering have been obtained by Messrs. B. Behrman; D. H. W. Channon; D. J. Comino (with distinction); A. H. Couzens; H. M. Fricke; R. Hynes; F. J. Jenvey; W. D. W. Ross; and J. R. Tugwood.

Australian Union and Women's Wages.—An interesting case came before Judge Curlewis in the Arbitration Court at Sydney in May. According to the *Sydney Sun*, Mr. D. E. Black, assistant secretary of the Electrical Trades Employés' Union, appealed against a decision of the Chief Industrial Magistrate concerning the wages of a woman employed by Parkinson (Australia), Ltd. In the lower court it had been contended that as the woman was employed winding electrical coils and on other fitting jobs, she was entitled to the award male rate of pay. However, the rate paid her by Parkinson, Ltd., was 1s. 5-8d. an hour, about half the male rate, and the union claimed that this was a breach of the award. The Chief Industrial Magistrate held that there had been no breach, as the woman had not had five years' experience as an electrical fitter, and was therefore not entitled to the award rates. "The fact that she is not a male precludes her from the prescribed rate," said Mr. Ferguson, who appeared for Parkinson (Australia), Ltd., the respondents. Mr. Cantor (for the appellants): That point was not raised in the case. Mr. Ferguson: But you can't get away from it.—"No! Not even an Act of Parliament could alter the fact that she is a woman," said Judge Curlewis.—The judge agreed with the Chief Industrial Magistrate's decision, and dismissed the union's appeal.

Automobile Breakdowns due to Electrical Equipment.—In a recent issue we drew attention to a report drawn up by the Union Automobiliste de France in connection with the causes of breakdowns of motor vehicles. A similar return has recently been published in this country by the Royal Automobile Club. The information would appear to indicate that, so far as the electrical equipment of automobiles is concerned, better results are being obtained in the United Kingdom than in France, for whereas in the latter country electrical failures are shown to be responsible for the breakdown of cars to the extent of 35 per cent., the corresponding proportion in this country is only 21.3 per cent. The short appended table showing the position in the two countries will doubtless be of interest to those engaged in the production of electrical equipment for motor vehicles:—

Causes of Motor Car Breakdowns.

	Great Britain.	France.
Ignition apparatus ...	18.4 per cent.	9 per cent.
Lighting equipment ...	1.7 ,,	16 ,,
Engine starters ...	1.2 ,,	10 ,,
	21.3 ,,	35 ,,

Electric Vehicles in Germany.—There are 1,102 private electric cars at present in use in Germany, of which Prussia is responsible for 893, Bavaria for 64, and the Hamburg district for 59, the remainder being spread over other parts of the country. The total shows an increase of 356 during the past twelve months. Greater progress has been made in the adoption of commercial electric vehicles, the number in use having advanced during the past year from 1,227 to 1,644; Prussia has 924 of the total, Bavaria following with 264, and the Hamburg district with 223.

What is a "Billion?"—Mr. J. W. Meares, C.I.E., electrical adviser to the Government of India, rendered a useful service to the World Power Conference at the first business meeting by drawing attention to the different ideas prevailing as to what was meant by the term "billion" in relation to the world's power resources. In English-speaking countries it was always held to mean one million millions, while in some foreign countries it was used to represent 1,000 millions—a vast difference. It was interesting to observe that when using the term "billion" some of the foreign delegates afterwards mentioned that they used it with the meaning given to it by Mr. Meares. The term "milliard" is correct English for one thousand millions.

The L.C.C. and Railless Traction.—In accordance with a resolution passed by the London County Council in February last the Highways Committee of the Council has investigated the possibilities of the use of railless trolley vehicles and omnibuses in the future development of the Council's tramway undertaking, in the place of further fixed tracks. From the experiences of other authorities with the three types of transport a large amount of data has been collected. The Committee has arrived at the following conclusions:—The tramcar has normally 50 per cent. more seating capacity than the other types of vehicles, and in wet weather this advantage is accentuated. The tramcar is under better control and has a higher standard of acceleration and deceleration; it is capable of a higher speed than the other vehicles. Being confined to rails, sideways skidding of tramcars is impossible, and they are least liable to accidents. The operating cost per seat mile is least in the case of the tramcar. The latter does not damage the roads so much as petrol and trolley omnibuses, and these omnibuses make no payments to local rates in respect of "track." The tramcar can operate in foggy or snowy weather long after the omnibus services are suspended. While the omnibus has greater flexibility, this is least available when it is most required.

In conclusion, the Committee states that the financial consideration is the most important. Tramcars are excluded from the profitable central London area, so that figures of earnings per car mile for tramcars and omnibuses in London are not strictly relative.

The question of the provision of trolley omnibus services or petrol omnibus services as extensions of existing tramway services is one that undoubtedly merits serious consideration where competition by another means of transport does not exist. It would appear, however, that short extensions involving a change of vehicles would not be successful in cases in which a through service is provided. However advantageous the operation of trolley omnibuses might be from the point of view of operating expenses, there are not many cases of extensions by means of trolley omnibus services that would provide such satisfactory results as extensions of the tramways.

Fireproof Bitumen.—On Tuesday last a demonstration was to be given at the works of Messrs. D. Anderson & Son, Ltd., Manchester, of the efficacy of processes for rendering bitumen stable and fire-resisting, which have been devised by Mr. R. O. Child, chemist to that firm. Three adjoining buildings were erected, of which the middle one was roofed with the new bitumen, the others with tiles and slates. The latter were to be set on fire simultaneously, to show that the bitumen roof between them would not ignite from the outside; afterwards the former was to be ignited from within, to show that the bitumen roof was immune from injury by fire, and finally water was to be poured on the intensely heated roof, to show that it would not crack or break. Whilst these tests were only indirectly of electrical interest, the important point is that the new-process bitumen is put forward for the insulation of wires and cables, and electrical accessories. It is claimed that bitumen treated by this process for cables will not permit the cores to decentralise.

Institution Notes.

The Faraday Society.—At the annual general meeting held on July 7th, Professor F. G. Donnan, C.B.E., F.R.S., was elected to succeed Sir Robert Robertson as President. The annual report records considerable activity during the past year, the result of which is reflected in the accounts, which show a deficit of £109 on the year's work. Eleven meetings were held during the year and of these four were general discussions. The sales of transactions and reprints amounted to nearly £900, a figure in excess of the amount received for subscriptions. It is surprising to note that the membership of this very active Society is only 432; an appeal for a larger membership is made in the annual report. Particulars relating to the Society may be obtained from the Secretary and Editor, Mr. F. S. Spiers, 90, Great Russell Street, London, W.C.1.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

At a meeting of the Mid-Lancashire Electricity District Advisory Board, at Blackburn, Mr. H. HOYLE, solicitor, of Bacup, was appointed clerk to the Board out of 91 applicants.

The marriage took place on July 17th, at Regent Square Wesleyan Church, Northampton, of Mr. JOHN EDWIN LESLIE BLYTHE, A.M.I.E.E., of Manchester, and Miss WINIFRED KATE STEVENS, of Northampton.

Mr. WILLIAM MORRISON, manager of the Gateshead and District Electric Tramways Co., who is to retire at the end of the present month, has been associated with tramway undertakings for 50 years. He commenced at Edinburgh in 1872, and remained there for ten years, after which he was appointed to the management of the Sunderland Tramway Company. When that company's undertaking was purchased by the Corporation with a view to its conversion to electric traction, Mr. Morrison remained in charge. In 1902 he joined the British Electric Traction Co. as travelling inspector and a year later was appointed managing director of the Gateshead system. On July 17th Mr. Morrison was entertained to lunch by the directors of the Gateshead Co. and directors of the Northern General Transport Co., at the Station Hotel, Newcastle-on-Tyne, and was presented with a cheque and a wireless set to mark the occasion of his retirement.

At the telegraph and electric workshops of the old Caledonian section of the L.M. & S. Railway at Glasgow, Mr. JOHN YOUNG was presented with a wallet of Treasury notes along with a handbag for his wife from fellow-workers and others, on his retirement, after 30 years' service.

On July 14th, at the Foreign Office, Mr. C. Trevelyan, President of the Board of Education, delivered to Sir ERNEST RUTHERFORD, F.R.S., the Franklin Medal and Certificate of Honorary Membership that were awarded to him by the Franklin Institute in recognition of his successful researches into the constitution of matter. Lord Balfour, Lord Rayleigh, and other persons of note were present, and congratulated Sir Ernest on the distinction which he had so well earned.

Hammersmith Borough Council Electricity Committee has made the following appointments to the electricity staff:—Mr. T. S. WALLIS, A.M.I.E.E., at present engaged at Wimbledon Corporation Electricity Works, to be assistant station superintendent, and Mr. R. A. POLLEY, repairs engineer. Mr. Polley has been carrying out the duties of this position pending the arrangements for his permanent appointment.

The vacant Principalship of the Northampton Polytechnic Institute, Clerkenwell, caused by the tragic death of Dr. R. MULLINEUX WALMSLEY in June, has been filled by the appointment of Mr. S. C. LAWS, M.A. (Cantab.), M.Sc.(Lond.), Principal of the Wigan Mining and Technical College for the past nine years. The appointment is subject to the approval of the London County Council. Mr. Laws was educated at University College, Nottingham, and St. John's College, Cambridge, where he attended as an 1851 research scholar and was admitted as an advanced student. He worked at Cambridge at the Cavendish Laboratory under Sir J. J. Thomson and received the special distinction of an extension of his 1851 scholarship for a third year, the University of Cambridge awarding him the certificate for distinguished research. He was awarded the M.Sc. by the University of London for experimental research undertaken while at Blackburn.

On the occasion of the visit of the King to Liverpool for the ceremonies in connection with the Cathedral, the following gentlemen representing the BRITISH INSULATED & HELSBY CABLES, LTD., which supplied the cables for the Cathedral, were presented to His Majesty:—Mr. James Taylor (chairman of the company); Mr. D. Sinclair (director and general manager); Mr. G. Nisbett (director and engineer); and Mr. W. Kerfoot (secretary).

Obituary.—MR. A. D. CHAMEN.—As was briefly mentioned in our last issue, Mr. Arthur Dalby Chamen, a brother of Mr. W. A. Chamen, of the South Wales Power Co., passed away on July 12th. Mr. Chamen, who was born in 1873, was educated at Lancing College, and at Forest School, Walthamstow. He was a pupil apprentice with Messrs. R. E. Crompton & Co., Ltd., at Chelmsford, from 1889 to 1893, and in the latter year he joined the staff of the Great Eastern Railway Co. in connection with the Liverpool Street Station electric lighting installation. In 1895 he was appointed electrical engineer to the company under the late Mr. John Wilson, chief engineer of the Permanent Way Department, &c., and carried out a new lighting and power installation at Parkeston Quay. In December, 1900, he joined the staff of the British Thomson-Houston Co., and carried out, among other things, important work in connection with the London United Tramways, the Isle of Thanet Tramways & Lighting Co., Liverpool Corporation (first instalment of three-phase plant), and the North Metropolitan Electric Supply and Tramways. In September, 1905, Mr. Chamen joined Messrs. Bramwell & Harris, and carried out power station work for the South Wales Electrical Power Distribution Co. near Pontypridd, and for the Cleveland & Durham Co. at Middlesbrough. In October, 1906, he joined the staff of the Newcastle Electric Supply Co., and carried out various duties in the counties of Northumberland and Durham. In May, 1910, he became the South Wales and West of England representative for Messrs. A. Reyrolle & Co. In 1913 or 1914 he became sales engineer to the Metropolitan Electric Supply Co. under Mr. J. S. Highfield. Later he joined the staff of Messrs. Edmundson's Electricity Corporation, Ltd., and in 1919 was appointed engineer and manager of the Bromley (Kent) Electric Lighting Co., Ltd., which post he held at the time of his death. He had carried out during the past five years the remodelling of practically the whole distribution system of the company's area, which includes Bromley, Chislehurst, Bickley, Elmstead, Widmore, &c., the supply now being taken in bulk from the South Metropolitan Electric Supply Co. Mr. Chamen, who has been suffering from ill-health for the past year or so, recently became rapidly worse. He was universally liked, and his relations with the staff and with the manual workers of the company were of the most cordial character, as was evidenced by the fact that practically the whole of them attended the funeral at St. Mary's Church, Plaistow, and afterwards at the cemetery in the same parish, where he was buried on July 15th.

HERR K. GERSTEIN.—The death is announced from Bochum of Herr K. Gerstein, the founder, in 1906, of the well-known Westphalian Electric Power Supply Co. The deceased's name is perpetuated in that of the large Westphalian power plant known as the Gerstein Station.

MR. W. M. MADDEN.—We regret to record the death which occurred while he was away on holiday at Gunwalloe, Cornwall, on July 18th, of Mr. Wyndham Monson Madden, of Longcroft, Haywards Heath. Mr. Madden, who will be remembered by many electrical friends by reason of his editorship for many years of *Lightning* (now the *Electrical Times*), was the eldest son of the late Canon Madden of Wakefield. He was a man of high scholastic attainments, being a Senior Wrangler, of Queen's College, Cambridge; a M.A. of Queen's College, Cambridge; and Professor of Mathematics at Launceston University, Tasmania. After relinquishing the last-mentioned appointment he took up the editorship of *Lightning* in the early 'nineties and this position he held until 1908. He shortly afterwards became editor of the *Contract Journal*, which position he occupied until the end. Mr. Madden was 74 years of age. The cause of death was a heart attack as he entered the water for a bathe. His son, Mr. W. Darcy Madden, M.I.E.E., is managing director of Messrs. Hick, Hargreaves & Co., Ltd., of Bolton.

MR. R. APPLEGARTH.—The death took place on July 13th, at his residence, Thornton Heath, Surrey, of Mr. Robert Applegarth, who was for a long period in business as an electrical engineer. He was in his 90th year.

SIR W. HERDMAN.—The death occurred suddenly in London on Monday night, at the age of 65 years, of Sir William Herdman, who was a former general secretary of the British Association for the Advancement of Science and its president in 1920.

LADY SIVEWRIGHT.—*The Times* announces the death at Ipswich of Jeannie, widow of Sir James Sivewright, K.C.M.G.

New Companies Registered.

Price's Battery and Radio Co., Ltd. (199,253).—Private company. Registered July 12th. Capital, £5,000 in 4,500 ordinary and 500 6 per cent. cumulative preference shares of £1 each. To carry on the business of manufacturers and repairers of batteries, dynamos, generators and motors, wireless sets, accumulators, condensers, valves, telephone receivers, loud speakers, and all other component parts of wireless apparatus, &c. The subscribers (each with one share) are:—A. J. Richardson, Lloyd's, E.C., underwriter; A. A. Price, 11, Hart Street, W.C.1, electrical engineer. The first directors are:—A. A. Price (permanent governing and managing director and chairman) and M. F. Agar. Solicitors: White & Co., 28, Sackville Street, W.

Selling Wireless, Ltd. (199,146).—Private company. Registered July 8th. Capital, £5,000 in £1 shares. To carry on the business of manufacturers of wireless apparatus of all kinds, &c. The first directors are:—Col. Joseph C. Chambers, "West Park," Headingley, Leeds (director, Motley & Green, Ltd.); J. E. Marshall, "Trevene," Otley, Yorks. (director, Thomas Marshall & Co., Ltd.); J. A. Couper, "Stoney Lea," Ilkley, Yorks. Qualification, 200 shares. Remuneration as fixed by the company. Solicitors: Armitage, Speight & Ashworth, Leeds.

Baker Brothers, Ltd. (199,201).—Private company. Registered July 5th. Capital, £1,500 in £1 shares. To acquire the business of electrical and mechanical engineers now carried on at 1, McLean's Buildings, New Street Square, Holborn, E.C.4, as "Baker Brothers," and to carry on the business of printers, electrical and mechanical engineers, &c. The permanent directors are:—R. M. Baker (managing director), 41, Fetter Lane, E.C., electrical engineer; W. P. Baker, 92a, North View Road, Hornsey, N.8, engineer. Qualification, 100 shares. Secretary: W. P. Baker.

Official Returns of Electrical Companies.

General Accessories Co., Ltd.—Mortgage on 89-91, Shernhall Street, Walthamstow, dated July 8th, 1924, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd., not exceeding £3,000.

Northampton Electric Light and Power Co., Ltd.—Satisfaction in full on July 1st, 1924 (a) of debenture stock secured by trust deeds dated January 5th, 1921, and April 11th, 1922, securing £100,000; and (b) of debenture stock secured by trust deed dated July 8th, 1910, securing £50,000.

Direct Spanish Telegraph Co., Ltd. (6,732).—Return dated April 17th, 1924. Capital, £95,000 in 13,000 ordinary and 6,000 preference shares of £5 each. 12,931 ordinary and 6,000 preference shares taken up. £94,655 paid. Mortgages and charges, nil.

Waste Heat and Gas Electrical Generating Stations, Ltd. (91,738).—Return dated March 27th, 1924. Capital, £350,000 in £1 shares. 320,000 shares taken up. £320,000 paid. Mortgages and charges, nil.

Electrical Distribution of Yorkshire, Ltd. (84,972).—Return dated March 18th, 1924. Capital, £250,000 in £1 shares. 150,000 shares taken up. £150,000 paid. Mortgages and charges, nil.

Return of allotments made up to April 1st, 1924, shows a further 100,000 shares allotted, payable in cash.

Northwood Electric Light and Power Co., Ltd. (66,312).—Return dated April 17th, 1924. Capital, £60,000 in 15,000 preference and 45,000 ordinary shares of £1 each. 6,800 preference and 12,507 ordinary shares taken up. £15,162 paid on 8,282 ordinary and 6,880 preference shares. £4,235 considered as paid on 4,225 ordinary shares. Mortgages and charges, £4,625.

Erskine, Heap & Co., Ltd. (126,262).—Return dated April 10th, 1924. Capital, £50,000 in £1 shares. 30,326 shares taken up. £7,826 paid. £22,500 considered as paid. Mortgages and charges, nil.

Return of allotments made up to April 15th, 1924, shows a further 15,163 shares allotted for a consideration other than cash.

Seaton and District Electric Light Co., Ltd.—Debenture dated June 30th, 1924, to secure £5,000, charged on certain freehold land at Homer Lane, Seaton, Devon, and the company's undertaking and property, including uncalled capital. Holder: The solicitor for the affairs of H.M. Treasury.

City Notes.

Marconi International Marine Communication Co., Ltd.

The directors' report for the year 1923 shows a gross revenue of £976,138, against £1,103,971 for 1922 and a net profit of £85,315, against £171,848 for 1922. During the year a lower scale of pay ruled in all seafaring ratings, and the salaries of telegraph operators have been reduced proportionately. Therefore the amount receivable by the company from shipowners for the services of telegraph operators has been substantially less. This is mainly responsible for the reduction in the gross revenue for the year. Apart from this circumstance, the real revenue of the company shows little change. The profits again suffered from the depression in trade. A number of vessels remained out of commission. The improvement which was manifest at the beginning of 1923 did not continue. The company has suffered from other exceptional circumstances during the year; it lost nearly £8,500 owing to the failure of the Banco di Sconto, of Rome, who were the company's bankers in Italy, while a substantial reduction in the profits of the company's foreign business resulted from the depreciation of the Italian and Brazilian currencies. As the reduction in profit during the past year was largely due to exceptional causes, the directors are of opinion that they are justified in recommending a final dividend of 5 per cent., making a total distribution of 10 per cent. for the year. There will remain £7,623 to be carried forward, which it is believed will be sufficient to provide for the balance of income tax and corporation profits tax.

Ward & Goldstone, Ltd.

The net profit for the year 1923-24, after providing for depreciation, directors' fees, bad debts, &c., was £29,758; from this is deducted an allowance of £5,130 for taxation, and £10,648 is added from the last accounts, making £35,276. Of this amount, interim dividends at the rate of 7 per cent. per annum on the preference and ordinary shares absorbed £7,325. It is now proposed to clear off the balance of the preliminary expenses account, £2,364; to place £3,000 to reserve for depreciation on investments; to reserve £10,000 for the creation of a dividend equalisation account; and to carry forward £12,587. The report states that it was the intention of the directors to increase the dividend distribution, but the unsettlement caused by the withdrawal of the McKenna duties and the crisis in the building industry rendered it desirable to conserve the company's resources by the creation of a dividend equalisation fund.

Argentine Light and Power Co.

The report for the year ended March 31st last mentions the acquisition of the share capital and debenture stock of the Argentine Tramways & Power Co., Ltd. Although the receipts from the lighting and power and traction undertakings showed satisfactory expansion, this was counterbalanced by increased taxes and wages and additional expenses. Under an agreement with the Municipality of Cordoba the San Vicente horse tramway is to be electrified, and other lines are to be extended. The loss on exchange for the year was £41,538, and, after providing for this loss, debenture interest and taxes, there was a balance of £90,174, to which was added £5,825 brought forward, making £95,999. This is to be distributed as follows:—Debenture stock redemption, £11,271; redemption of ordinary and preference share capital, £5,000; writing off balance of suspense account, £18,992; dividend on 7 per cent. cumulative preference shares, £46,970; carried forward, £13,766. The meeting is to be held to-day (Friday).

Chili Telephone Co., Ltd.

The gross expenditure during the year ended March 31st last showed a gross revenue of £194,424, and the deduction of expenditure left a profit of £50,372. To this was added £3,144 brought forward, making £53,516. It was to be proposed at last Wednesday's meeting to pay a final dividend of 3s. per share, free of tax, making 6 per cent., free of tax, for the year; to place £18,000 to the general reserve; to transfer £2,000 to the reserve for renewal of plant; and to carry forward £3,816. The number of subscribers served by the company rose during the year from 20,739 to 21,922. Although the average rate of exchange was lower, the commercial situation in Chile has shown continued improvement. The new concession which has been obtained provides that 40 per cent. of new issues of capital will be offered in Chile. It is proposed to capitalise £99,000 of the amount standing to the credit of the general reserve, and to allot one £5 share to present holders for every five shares held. The directors intend to increase the nominal capital of the company to £750,000 by the creation of 50,000 new shares of £5 each.

Aron Electricity Meter, Ltd.

Col. R. E. Crompton, C.B., presided at the annual meeting, on July 15th, and in moving the adoption of the report and accounts (ELECTRICAL REVIEW, July 11th, p. 70) said that the figures presented were merely supplementary to those brought forward at the general meeting four months earlier. There were only £1,300 five per cent. first mortgage debentures outstanding; the item "Sundry creditors" had been reduced by over £13,000; and the item of "Dividends, £32,705," had disappeared. On the other side of the balance sheet, the figure given for goodwill was more than represented by the value of shares in Aron Taximeter, Ltd.; sundry debtors had been reduced by £9,000; and cash at bankers was £38,000 less. A sum had been set aside for income tax for the preceding nine years, but until the matter was settled it would not be known if that sum was sufficient. The profit shown as made in Austria was for six months only. As regarded the current year, there appeared to be an improvement in the London business.

The report and accounts were adopted, and two years' dividends on the preference shares were approved.

West India & Panama Telegraph Co., Ltd.

The report for 1923 states that the amount to the credit of revenue is £94,127, and from this are deducted expenses of £91,071, leaving a margin of only £3,056. To this is added £399 interest, making £3,455. A debit balance of £85,534 brought forward is deducted, leaving a net debit balance of £82,079. The company is still working at a small profit. With the commencement of the competitive Government services in October next both the annual subsidies and the authorised additional charges will cease, and the company will not be in a position to continue operations. The directors protest against the treatment which the Government has accorded the company, pointing out that it contrasts very unfavourably with the terms on which other companies have operated. Meeting: July 30th.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted :—

Madras Electric Tramways (1904).—100,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 100,000.

North Wales Power Co.—Scrip, fully and partly paid, for £1,500,000 4½ per cent. guaranteed debenture stock, 1930-53.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Dudley, Stourbridge, and District Electric Traction Co.—£105,000 6 per cent. debenture stock.

South Wales Power Co.—250,000 6½ per cent. cumulative preference shares of £1 each, issued at par, partly and fully paid, Nos. 1 to 250,000.

American Telephone and Telegraph Co.—81,544 shares of $100 each, fully paid.

English Electric Co.—£26,494 6 per cent. convertible debenture stock.

Application has been made to the Committee to allow the following to be officially quoted :—

American Telephone and Telegraph Co.—$8,154,400 capital stock.

North Wales Power Co.—381,715 ordinary shares of £1 each fully paid, Nos. 1 to 381,715.

Folkestone Electricity Supply Co., Ltd.—An extraordinary general meeting is to be held at Folkestone to-day (Friday) to confirm the resolutions passed at a previous meeting authorising an increase of £50,000 in the company's capital, and the splitting of each of the £5 shares into five of £1 denomination.

Calgary Power Co., Ltd.—The net profit for 1923 was $119,605, as against $94,778. After adding the amount brought forward, $88,815 is put to depreciation and $263,206 carried forward. A new transmission line which has cost $250,000 is to be put into service this year.

Capital Reduction.—S. SMITH & SONS (MOTOR ACCESSORIES), LTD. AND REDUCED.—A petition for the confirmation of the reduction of the capital of the company from £2,000,000 to £952,000 has been presented to the High Court, and will be heard in London on July 29th.

W. & T. Avery, Ltd.—For the year ended March 31st the directors recommend a further dividend on the ordinary shares, making 15 per cent. total. £10,000 to reserve, £38,112 to be carried forward.

Anglo-American Telegraph Co., Ltd.—Interim dividends for the quarter ended June 30th of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less tax.

Electrolytic Zinc Co. of Australasia.—The directors have declared a dividend at the rate of 9 per cent. per annum for the six months to June 30th last on the preference and ordinary shares.

Traction and Power Securities, Ltd.—The following interim dividends have been declared :—2½ per cent. on the 5 per cent. cumulative preference shares and at 4 per cent. on the ordinary stock.

France.—La Société Electro-metallurgique de Dives is increasing its capital from 25 to 40 million fr. The new 500-fr. shares are being offered to existing shareholders at a premium of 250 fr. per share.

Liverpool Overhead Railway Co.—The directors state that they are unable to declare interim dividends on either class of shares.

Altrincham Electric Supply Co., Ltd.—A dividend of 7½ per cent. actual for the year on the ordinary shares is announced.

Llanelly and District Electric Light and Traction Co., Ltd.—A dividend at the rate of 6 per cent. has been declared.

Chelsea Electricity Supply Co., Ltd.—Dividend of 9 per cent. per annum, less tax, on the ordinary shares for the half-year.

Mather & Platt, Ltd.—Interim dividend of 5 per cent. actual, tax free, on the ordinary shares.

Brazilian Traction, Light and Power Co.—Quarterly dividend of 1 per cent. on the ordinary stock.

Stocks and Shares.

MONDAY EVENING.

CONDITIONS of the money market have developed a tendency sufficiently easy to flatter an expectation that there may be no rise in the Bank Rate for another month or so. In consequence of this, a general recovery occurred amongst all gilt-edged stocks. The usual corollary, however, of sympathetic strength spreading to industrial fixed-interest issues, debentures and preferences alike, has failed to materialise this time, owing principally to the fact that there are large quantities of new issues still in the hands of the underwriters, who are anxious to get rid of their commitments as soon as they see a chance of doing so without loss. A dozen recently-issued stocks and shares stand at a discount, but this fact does not deter fresh borrowers from adventuring into the market. The knowledge that there are other newcomers yet to put in an appearance has the effect of restraining money that might be tempted otherwise into the existing Stock Exchange securities, old and new alike.

Political affairs abroad, more especially in Brazil, act as a deterrent upon enterprise, though the meetings of the latest Peace Conference in London are deemed promising enough to justify the hope that something definite will at least come of the international efforts to find a basis for permanent peace.

In the new issue market, Whitehall Electric preference have fallen to 1s. 3d. discount, on the approach of the call of 10s. due this Monday. The debenture, however, has hardened to ¾ discount. West Gloucestershire Power 5½ per cent. 1st Mortgage, which came out at 97½, can be bought about 3½ discount, and the company's 6 per cent. preference shares, issued at 20s. 6d., at about 1s. 6d. discount. South Wales Power 6½ per cent. preference are quoted at 6d. discount, and Barcelona Traction 6½ per cent. bonds at 2½ discount. North Wales Power 4½ per cent. at 95½ are 5s. below issue price, and Shropshire Electric 5½ per cent. debentures at 2¾ premium, stand out in pleasant contra-distinction to some of the other recent-comers. British Insulated 5 per cent. debentures command 1 premium. British Automobile Traction debentures hardened a little to 2 discount, after being nearly a point lower, and Madras Electric 5½ per cent. debentures, offered at 93, are 1 discount.

Brazilian affairs continue to give rise to grave anxiety. The news is extremely scanty, and the censorship rigidly maintained. In the circumstances, rumour has to play the part of newsbearer, and has been very busy weaving various tales, from hour to hour, around Brazilian conditions. The market for the Brazilian Government bonds is harder than it was at one time a few days back, and Brazilian Tractions, which dipped to 48½, are now up to 53½, showing a gain of ¼ on the week. The preferred shares stand at 98, business having recently been transacted at 96. Anglo-Argentine Trams are quiet, the only changes being a fall of 1 each in the 5 per cent. and 4 per cent. debenture stocks. British Electric Traction weakened, possibly on the partial success which attended the issue of British Automobile stock, and also as a natural reaction after the very substantial rise the company's issues have recently enjoyed. Mexicans are heavy; the Light and Power Common shares are 2 down at 14 and the preferred are 1 lower at 43.

Eastern Extensions slipped back to 16, and the market in this group is not particularly firm, although prices, other than that for "China" shares, are nominally maintained. Marconis seem to be in the position of a good man troubled with adversity, unable to make headway, and after touching 32s. the price reacted to 31s. 3d. To some extent this is because the Marconi International Marine report shows this company to have done badly last year. The net Marconi Marine profits of £85,300 are practically half as much as those made by the company in the previous twelve months. The directors recommend 10 per cent. dividend as against 12½ per cent. for 1922, because they maintain that the decline in net earnings was largely due to exceptional causes. The carry-forward of £7,600 is £34,000 less than was brought in. The dividend decision implies robust faith in the future on the part of the Board. The price of the shares has fallen from a guinea to 19s. 6d. Automatic Telephones have been improving, and the price is up to 27s. 6d., an improvement which influenced an advance in International Telephones to 21s.

Underground Electric income bonds at 98 show a moderate gain. Metropolitan Consolidated rose to 81 on the eve of the dividend declaration this week. The oft-discussed possibility of the East London Railway being taken over by a bigger brother is said to have come to a head in an offer from the Southern Railway, though the terms may not meet with approval from the holders of the junior debenture issues. London traction descriptions have not moved. Singapore Electric Trams went back to 8s. 9d. upon further publicity being given to the disparity between the price of these shares and that of the company's debenture stock—a matter already mentioned here. Cape Electric Trams are better at 18s. 9d. Yorkshire Electric Trams at 1 3/16 have put on a fraction.

Electricity Supply shares are so steady that there is no quotable change in this week's catalogue of prices. The County of London and the associated South London have both advanced their interim dividends by 1 per cent. As market factors, these announcements are neutralised by the threatened strike of electricians. According to the disturbers of industrial peace, the strike, if it materialises, is to embrace wide circles of electrical workers; it should be beneficial to bulls of gas stocks and candles.

Amongst manufacturing shares, Callender's are better at 52s., and the company's B preference have risen to 26s. 3d. General Electrics are unchanged at 18s. 3d. and Siemens at 18s. 9d. Rubber shares present a cheerier front, thanks to the produce having hardened to 1s. per lb. Engineering and allied companies' shares move within narrow limits. The friction between Japan and the United States has not prevented the successful placing of a substantial bond issue by a Japanese electrical corporation with a firm of American financiers. Tokyo 6 per cent. debentures are firm at 89½.

The Chili Telephone Company holds a meeting on the Wednesday in this week for passing resolutions to capitalise £99,000 of the general reserve account. At the same time, the necessary authorisation will be sought for increasing the nominal capital to three-quarters of a million pounds.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price July 21, 1924.	Rise or fall.	Yield. p.c.
Brompton Ordinary	1	12	10	37/-	—	*£5 8 1
Charing Cross Ordinary	1	14	14½	42/-	—	6 18 2
do. do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	45/9	—	6 11 0
do. do. 6 % Pref. ...	1	6	6	23/6	—	5 2 2
County of London	1	10	15	49/6	—	6 1 0
do. do. 6 % Pref. ...	1	6	6	1¼	—	5 6 8
Edmundson's Ordinary	8	7	7	4⅝	—	4 6 1
do. 6 % Pref.	5	6	6	5⅝	—	5 11 7
Kensington Ordinary	5	12	14	9½	—	7 3 7
London Electric	1	10	10	31/-	—	6 9 0
do. do. 6 % Pref. ...	5	6	6	5⅝	—	5 11 7
Metropolitan	1	8¾	10	1⅞	—	5 14 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	9½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	24/6	—	5 14 3
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	21/3	—	5 13 0
Urban Ordinary	1	—	4	18/3	—	4 7 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	5	14½	17½	13⅜	—	6 10 10
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1½	—	5 12 0
Westminster Ordinary	5	12	15	10½	—	7 6 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/3	—6d.	7 16 0

Home Rails.

Central London Ord. Assented	Stock	4	4	69½	—	5 16 10
Metropolitan	,,	3½	4	81	+ ½	4 18 9
do. District	,,	3	3½	50xd	—	7 0 0
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A" ...	1	Nil	Nil	7/6	—	Nil
do. do. Income Bonds	5	6	6	99	+1	*6 2 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	5	6	109½	—	5 16 0
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Chile Telephone	5	6	6	6⅜	—	4 9 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension... ...	10	10	10	16	—	6 5 0
Eastern Tel. Ord.	Stock	10	10	£62½	—	6 3 1
Globe Tel. and T. Ord.	10	10	10	17½	—	5 14 3
do. do. Pref. ...	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	27½	—	8 1 6
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	—	1⅞	—	9 13 0
Oriental Telephone Ord.... ...	1	12	12	1⅝	—	*6 3 0
United R. Plate Tel.	5	8	8	6⅜	—	*5 18 6
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16½	—	6 2 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	8⅛	—	8 12 6
do. do. 2nd Pref. ...	5	5½	6	2⅛	—	10 4 4
do. do. 5% Deb. ...	Stock	5	5	73½	—1	6 16 0
British Electric Traction Ord. ...	,,	8	6	90½	—½	6 8 4
do. do. 6% Pref. ...	,,	6	6	103	—½	5 16 6
Brazil Traction	100	4	4	58½	+ ½	7 9 7
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	87½	—	5 14 3
do. do. Preferred	,,	5	96/-	83½	—	*5 5 3
do. do. Deferred	,,	8	127/-	101½	+1	*6 8 0
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	6/6	—	7 13 10
London United Tram. Deb. ...	Stock	4	4	47	—	8 10 2
Mexico Trams. 5% Bonds ...	—	Nil	5	68	—	7 7 1
do 6% Bonds ...	—	Nil	Nil	40½	—	Nil
Mexican Light Common ...	100	Nil	Nil	16	—2	Nil
do. Pref.	100	Nil	Nil	48	—1	Nil
do. 1st Bonds ...	—	5	5	69½	—	7 17 6

Manufacturing Companies.

Babcock & Wilcox...	1	20	12	47/6	—	*5 1 2
British Aluminium Ord.... ...	1	5	5	25/9	—	3 17 8
British Insulated Ord.	1	15	15	2⅝	—	5 14 3
Callenders	1	15	15	52/-	+9d.	5 15 5
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	Nil	⅝	—	8 17 10
Edison-Swan	4/-	7½	—	5/-	—	6 0 0
do. ,, 5% Deb.	Stock	5	5	75½	—	6 12 5
Electric Construction	1	10	10	1½	—	6 13 4
English Electric	1	8	5	15/9	—	6 7 0
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	18/3	—	5 9 7
Henley	1	15	15	2½	—	5 11 6
do. 4½ Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	1½	—	*7 5 6
Met.-Vickers Pref....	2	8	8	2⅞	—	6 11 2
Siemens Ord.	1	5	—	18/9	—	5 6 8
Telegraph Con.	13	20	20	24½	—	*4 11 7

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price July 12.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£125 to £130	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£227	£1 inc.
Grade II ... ... ,, ,,	£162	£10 inc.
Grade III ... ... ,, ,,	£40	£1 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ... ,,	9½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	...
c ,, Bars (best selected) ... per ton	£92	...
c ,, Sheet ... ... ,,	£92	...
c ,, Rod ... ... ,,	£92	...
d ,, (Electrolytic) Bars ... ,,	£66 10s.	25s. inc.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£76 10s.	25s. inc.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod ... ... ,,	2/- to 3/6	...
f Sheet ... ... ,,	2/- to 3/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	7/0	...
h India-rubber, Para fine ... ... ,,	1/-	1d. inc.
Iron Pig (Cleveland Warrants) ... per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£34	10/- inc.
g Mercury ... ... per bot.	£12 15s. to £13	5/- inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/5½	...
p ,, ,, wire ... ... ,,	1/8½	...
o Platinum ... ... per oz.	£24	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	8d.	...
n Tin, Block (English) ... ... per ton.	£247 to £247 10s.	£20 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
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Gold from Mercury.—Reports from Berlin announce that Prof. Miethe, Director of the Photochemical Laboratory at Charlottenburg High School, has found gold in a black deposit which is formed in the quartz mercury-vapour lamp invented by Jannecke. Careful investigation showed that gold was not present in the mercury used in the construction of the lamp; it appeared after an electric current had been passed through the lamp for a period of "from 20 to 200 hours." The discovery was made in the course of experiments on the change of colour of transparent minerals caused by exposure to ultraviolet rays. Mercury having an atomic weight next above that of gold, it was obvious that the latter might conceivably result from the disruption of the atoms of the former, and this apparently is what took place. No doubt is entertained by German authorities as to the reliability of Prof. Miethe's work, and experiments are to be made with an electric furnace devised by Prof. Lohmann in 1914, with which extremely high temperatures can be attained, it being thought that by this means the transmutation of mercury into gold (plus helium or hydrogen) may be accomplished more rapidly.

Kilocycle-metre Conversion Table.—The United States Bureau of Standards has issued a circular letter (No. 123), in which it states that, owing to the tendency of radio engineers to express frequencies in kilocycles rather than in wavelengths, it has prepared a table for the conversion of one to the other. This table accompanies the letter, and ranges from 30 to 10,000 in tens in one column and from 9,994 to 29.98 in the other. The columns are, of course, interchangeable.

Short-Wave Directional Radio-Telegraphy.

The Marconi "Beam" System.

SOME results that have been obtained over very great distances by short-wave directional radio-telegraphy, more generally known as the "beam" system, were described recently at the Royal Society of Arts by Senatore Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., who pointed out that over 30 years ago Hertz conclusively proved that short waves obeyed the same laws as did waves of light with regard to speed of propagation, reflection, refraction, and diffraction.

The lecturer recalled the fact that when he first came to England, over 28 years ago, he showed the late Sir William Preece, then Engineer-in-chief of the Post Office, the transmission and reception of intelligible signals over a distance of 1½ miles by means of a beam system employing short

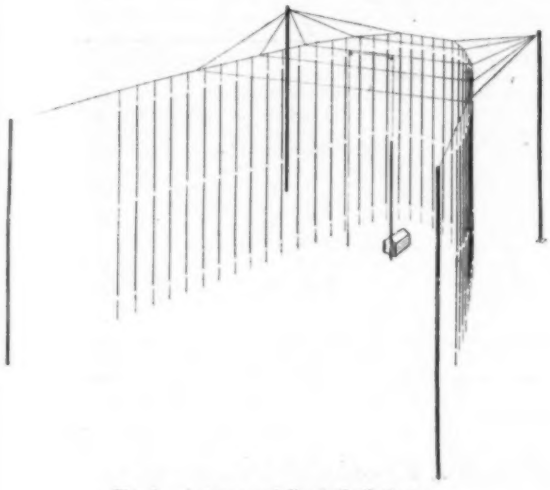

Fig. 1.—Antenna and Parabolic Reflector.

waves and reflectors, whilst, curiously enough, by means of an antenna or elevated wire he could only get signals, at that time, over a distance of half a mile. The progress subsequently made with the long-wave system was, however, so rapid that it diverted all research from short waves, which was regrettable, for it has only recently been discovered that such waves, which alone can in practice be confined in beams to definite directions, are capable of results unobtainable by the use of the lower-frequency system.

The reflectors now used are composed of a comparatively small number of wires parallel to the antenna and spaced around it on a parabolic curve, of which the transmitting or receiving antenna constitutes the focal line (fig. 1). Since 1916 various patents have been taken out by Mr. Marconi and Mr. C. S. Franklin, and the latest describes an arrangement in which the antennæ and reflector wires constitute grids parallel to each other, the aerials being energised simultaneously from the transmitter at a number of feeding points through a special feeding system, so as to ensure that the phase of the oscillations in all the wires is the same. The directional effect of such an arrangement is a function of its dimensions relative to the wave length employed (fig. 2), and tests over a land range of 97 miles between Hendon and Birmingham, the power supplied to the valves being approximately 700 watts, demonstrated that the value of the energy received when both reflectors were used was 200 times that of the energy that could be received without reflectors.

In April, May, and June of last year a series of long-distance tests was carried out between Poldhu, in Cornwall, and the S.Y. *Elettra*. Mr. C. S. Franklin was responsible for most of the design and operation of the transmitting arrangements at Poldhu, and Mr. G. A. Mathieu was in charge of the receiving apparatus on the yacht, Mr. Marconi being on board during the whole of the tests. Mr. Mathieu was able to make some valuable calculations based on the observed results, especially with regard to the absorption or attenuation of the waves brought about by sunlight. No receiving reflector could be employed, and therefore the strength of the received signals and the ranges covered must have been considerably less than could have been obtained had it been possible to use a fixed receiving station equipped with a suitable reflector. However, the tests proved by the definite results obtained that the then prevailing impressions must be erroneous, at least in so far as they concerned waves about 100 metres long, for it was observed that (*a*) the day ranges proved to be reliable and not inconsiderable; (*b*) the night ranges were much greater than anyone, himself included, had anticipated, and no doubt very considerably exceeded the maximum distance to which he was able to proceed with the *Elettra*; and (*c*) intervening land and large portions of continents did not present any serious obstacle to the propagation of such waves. It was discovered that it was no means correct in dealing with such waves to refer to distances covered during daylight as day-ranges, as the strength of the signels which were received during the hours of daylight varied definitely and regularly in accordance with the mean altitude of the sun, over the region intervening between the two stations.

Perhaps one of the most remarkable scientific results was the fact, quite definitively ascertained, that the co-efficient of the well-known Austin formula for the propagation of the waves was defective when applied to short-wave phenomena. It will be remembered that this absorption factor is an exponential of the form ε^{-x}, where x (the negative index) is given by Austin as the product of a *constant* multiplied by the ratio of the distance between the stations and the square root of the wave length used. Slightly modified values for that constant have been suggested during recent years, and different values have also been suggested for daylight and night communication, based on the so-called night effect.

The results of their measurements were that for short waves of the order of 100 metres this constant must be replaced by a variable, which was a linear function of the mean altitude of the sun, calculated on the great circle track between the two stations. In other words, the coefficient of absorption is a function of the time, the seasons, and the relative geographical situation of the stations, and can now easily be ascertained for wavelengths of the order of 100 metres.

The tests show that short waves behave quite differently from long waves in their propagation, and that the weak periods at sunset and sunrise followed by a recovery in signal intensity observed with long waves over great distances do not occur in the case of short waves. Also there is probably no sharp limit between short and long waves, and the change from the behavior of short waves (of, say, 100 metres) to that of long waves (of, say, 10,000 metres) may follow a slow process of transformation.

Very likely, over very long distances, as the wavelength increases there may be a tendency for the signals to recover progressively during the period of no signal for short waves. With regard to the "X's" and atmospheric disturbances generally, they usually appeared to be (during the daytime) less severe than those experienced when working with the longer waves. During the night time, even when receiving at St. Vincent, which is 2,230 nautical miles from Poldhu and well within the tropics, absolutely none of the "X's" or atmospherics which were there experienced ever approached being able to interfere in any way with the reception of signals from Poldhu.

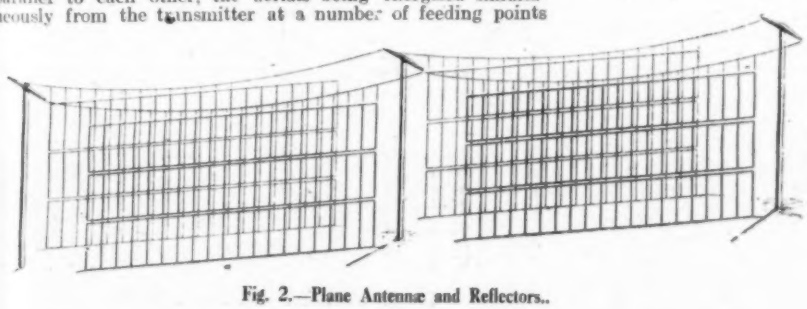

Fig. 2.—Plane Antennæ and Reflectors.

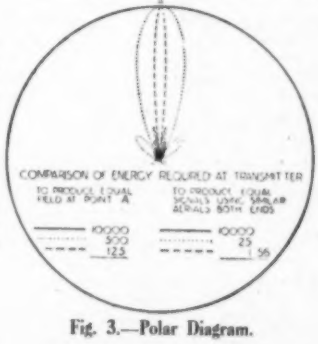

Fig. 3.—Polar Diagram.

During the tests to the *Elettra* on a 97-metre wave the Poldhu transmitter consisted of eight glass valves (standard M.T.2) in parallel, the input being 12 kW; the radiation from the aerial was approximately 9 kW. The parabolic reflector concentrated the energy towards Cape Verde, and gave a

strength of field in that direction to produce which would have required a radiation of approximately 120 kW from the aerial without a reflector. On the yacht the receiving aerial was a vertical wire, the top of which was at a height of 20 metres above sea level. The receiver consisted of an aerial circuit, a closed condenser intermediate circuit, a frequency changer circuit, two high-frequency tuned amplifications, and an auto-heterodyne detecting valve to which could be added two stages of low-frequency amplification.

After preliminary tests in Falmouth Harbour on April 11th, the *Elettra* sailed; a first series of tests was carried out without the transmitting reflector. After rounding Cape Finisterre (Spain) the anticipation that the intervening land would have cut off signals during daytime and also considerably weakened them during the night was not verified. Signals during the

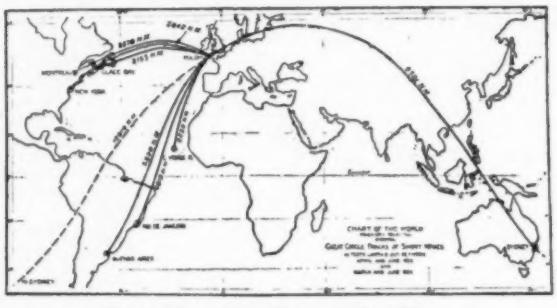

Fig. 4.—Great Circle Tracks of Short Waves.

day weakened according to the distance and altitude of the sun, but were received right up to Seville (780 miles from Poldhu), although practically the whole of Spain, consisting of over 300 miles of high mountainous land, intervened.

At Gibraltar (820 miles) a better strength of signals was noticed during daylight, probably in consequence of the yacht being anchored in a more open space; similar results were also obtained at Tangiers (840 miles) and at Casablanca (970 miles). The night signals were always and in all places throughout the whole of the cruise, extraordinarily strong and capable of being received at all times without using an amplifier, with the aerial out of tune, or disconnected, or without using heterodyne.

At Casablanca instructions were telegraphed to hoist the reflector aerials at Poldhu, and it was ascertained that signals could be received by day up to 1,250 nautical miles when that station was using 12 kW. Although at St. Vincent, Cape Verde Islands, the anchorage was partly screened by mountains, daylight reception was still possible for a few hours after sunrise and for some time before sunset. The night signals continued to arrive from Poldhu at all times with apparently unabated strength, notwithstanding that the distance had increased to 2,230 nautical miles. Mr. Mathieu estimated the strength of the night signals at St. Vincent to be from 400 to 500 microvolts per metre in the aerial, and no trouble was ever experienced with atmospherics or "X's."

At St. Vincent the signals received from the Post Office station at Leafield were weak and often unreadable, but even when Poldhu gradually reduced its transmitting power from 12 to 1 kW, the signals received at St. Vincent were still stronger than would have been necessary for commercial work over that distance. Mr. Mathieu calculated that the signals would still have been readable at St. Vincent, even should the power at Poldhu have been reduced to 1/10th of a kilowatt. The night signals received at St. Vincent, even when Poldhu was using only 1 kW, were much stronger than those received from Carnarvon, or those which could be received at either St. Vincent or Madeira from any of the other European or American high-power stations.

The signals by night or by day did not appear to be subjected to lengthy fluctuations in strength, nor inclined to give freak results. The results obtained could always be repeated over the same distances under similar conditions in respect of the sun's altitude. Although sunrise at St. Vincent occurred about three hours later than at Poldhu, nothing was observed which would indicate the existence of the weak periods so noticeable under similar circumstances in radio reception between Europe and North America.

The results of these tests were sufficient to convince Mr. Marconi that it would be possible to carry out reliable commercial services for a large number of hours out of the 24 over distances of at least 2,300 nautical miles by utilising only about 1 kW at the transmitting stations, and that the practical range of the system when using 12 kW had not even been approached. Therefore, the station at Poldhu was somewhat improved, the power employed was increased to about 20 kW, and since February of this year a further series of tests was made over ranges which included the greatest possible distances separating any two places on earth.

A special receiver was installed on the s.s. *Cedric* and reception tests were carried out with Poldhu by Mr. Mathieu during a journey of that vessel to New York and back. No reflectors of any kind were employed at either end, the wavelength was 92 metres, and the transmitter comprised two oil-cooled valves of special design controlled by an independent "drive" circuit to ensure steadiness of wave-length; the power supplied to the main valves was 21 kW, giving a radiation of approximately 17 kW. The *Cedric's* signals could be received during the daytime up to a distance of 1,400 nautical miles, and it was confirmed that the signal's intensity was symmetrical to the mean attitude of the sun at all times.

The intensity of the signals varied inversely in proportion to the mean altitude of the sun when above the horizon and, according to the measurements carried out by Mr. H. H. Beverage, research engineer of the Radio Corporation of America, the average strength of the signals at New York was 90 microvolts per metre.

Mr. Ernest T. Fisk, managing director of the Amalgamated Wireless (Australasia), Ltd., reported that he could receive the Poldhu transmissions at his house in Sydney every day perfectly well from 5 to 9 p.m. (Greenwich m.t.), and also that he had received them between 6.30 and 8.30 a.m. on an improvised receiver consisting of 2 stages of high frequency, a tuned plate and grid, with one rectification. He added that he had read every word that was sent and that the signals were better than those he had received from the high-power station at Carnarvon.

The experiments with Australia were continued during May, consistently good results being obtained at two receiving stations situated in the vicinity of Sydney. It seemed obvious, if the position and altitude of the sun were considered, that during the morning period the waves travelled from England to Australia in a westerly direction across the Atlantic and Pacific Oceans, along the longest route (approximately 12,219 nautical miles), whilst during the evening period they travelled in an easterly direction over Europe and Asia, along the shortest route (about 9,381 nautical miles, as indicated in fig. 4). In Canada, at Montreal, reception was possible for 16 hours out of the 24.

With rather experimental arrangements at Poldhu intelligible speech was transmitted for the first time in history from England to Sydney, Australia, on May 30th of this year. Oil-cooled main and modulating valves were employed; the wavelength was 92 metres, and an independent "drive" was employed for controlling the main valves. The total power supplied to the valves was approximately 28 kW, divided up as follows: 18 to the main valves, 8 to the modulating valves, and 2 to the "drive" valves; no reflector was employed at either end.

A continuous development of the short-wave transmitter has been taking place at Poldhu: to utilise considerable power, required the study and development of circuits for paralleling valves satisfactorily; also the design of special valves to maintain the wave-length steady has necessitated the application of an independent "drive." These problems have been solved satisfactorily and the production of commercial transmitters dealing with powers up to 50 kW now presents no difficulties.

The results between England and Australia easily constitute a record for ratio of distance to wave-length, for by the shortest route Sydney is approximately 189,000 wave-lengths from Poldhu. It appears to have been proved conclusively (in Mr. Marconi's opinion) that adequately designed reflectors, even if of comparatively moderate size, will enormously increase the effective strength of the signals, besides increasing the number of hours during which it will be possible to communicate with very distant countries. Moreover, they reduce all types of interference, unless, of course, the direction from

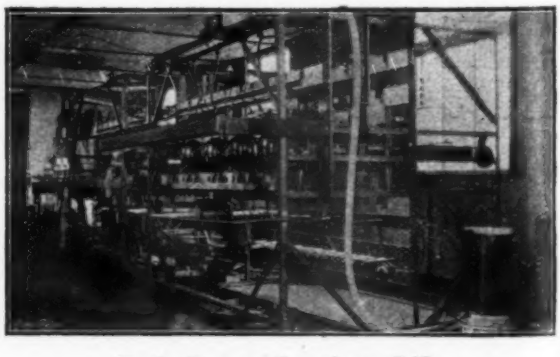

Fig. 5.—Short-wave Transmitter at Poldhu.

which the interference may be coming happens to coincide exactly with that of the corresponding station.

The energy magnification, due to the concentration of the energy by the directional effect, has been calculated by Mr. Franklin and tests carried out at Poldhu have fully confirmed his figures. Fig. 3 shows a comparative polar diagram of the field in all directions from three different transmitters; the solid circle is a polar curve of a plain non-directional aerial; the dash curve is of a two-wave-length aperture reflector; the black curve is of an 8-wave-aperture reflector, such as it is proposed to use for practical purposes. The case which was tried experimentally at Poldhu was an aerial and reflector ½-wave high, 3 waves wide, the aerial being fed at four points with a cable feeder system; a horizontal polar magnification figure of about 30 was found. Mr. Franklin be-

lieves there are some general laws regarding these aerials, which may be stated as follows:—

(1) The ratio of the loss by radiation to the loss by ohmic resistance, and therefore the efficiency, remains constant for all sizes of the aerial at the same frequency; this efficiency figure can easily be of the order of 80 per cent.

(2) The natural decrement of the aerial is very high and remains constant whatever the extension, as the ratio of the inductance to the resistance of the aerial remains the same.

(3) The greatest magnification for a given area, and therefore for a given cost, is obtained by having equal areas at the transmitter and receiver; thus, an aerial of 20 square wave-lengths at the transmitter and receiver gives a magnification of 200, but if divided into two aerials at the transmitter and receiver, each of 10 square wave-lengths, gives a magnification of 10,000.

(4) For a given area of aerial at the transmitter and receiver, the magnification grows as the fourth power of the wave frequency used; thus, assuming aerials 1 kilometre wide and one hundred metres high at the transmitter and receiver, they would each be 10 square wave-lengths for a 100-metre wave and would give a combined magnification of 10,000. For half this wave-length (50 metres) each aerial would be 40 square wave-lengths and would give a combined magnification of 160,000. Up to what ranges this fourth power law can be effective in compensating for the greater attenuation of the shorter wave has yet to be ascertained.

The energy capacity of such aerials is enormous, and they could never conceivably be worked to their limit. It would be quite possible practically to superimpose several waves, and thus several services, on the same aerial. The fact should not be lost sight of that very high speeds of working appear to be possible only if short waves are employed, whilst speeds of the same order are quite unattainable with the long waves now in general use for long-distance radio communication.

In other words, there exists no theoretical reason why, with a frequency of 3,000,000 (such as is the frequency of oscillation of a 100-metre wave) the speed should not be one hundred times as great as the speed attainable with a frequency of 30,000, which represents the frequency of a wave-length of the order of those which it is proposed to use for the Imperial "chain" of stations.

Between June 12th and 14th (inclusive) of this year, further radio-telegraphic tests were carried out between Poldhu and a small receiving station at Buenos Aires, in the Argentine, the distance between the two points being 5,820 nautical miles (10,780 kilometres). The wave-length was 92 metres and the power to the main valves 21 kW, which gave a radiation of 17 kW. The parabolic reflector concentrated towards South America a strength of field which would, otherwise, have required a radiation of approximately 300 kW from an aerial without a reflector to produce the same effect. Very strong signals were received for over ten hours each day at Buenos Aires, and every message was correctly received in one transmission.

Exports and Imports of Electrical Goods and Machinery in June, 1924.

THE electrical exports during the month of June showed a decrease of £305,034 as compared with the May total, large reductions occurring in all sections, with the exception of railway and tramway motors. In this section an increase of £40,728 was recorded. As compared with June, 1923, the month's total showed an increase of £98,708.

The electrical export totals for the first six months of 1923 and 1924 were:—

Exports.	1923.	1924.
Electrical goods and apparatus	£4,146,632	£4,759,956
Electrical machinery	£1,944,482	£2,495,636
Totals for six months ...	£6,091,114	£7,255,592

Electrical imports for the month were £78,267 down as compared with the previous month's total, due to reductions in the sections for electrical goods and apparatus unenumerated (£13,903 dec.), carbons (£12,880 dec.), electrical machinery (£22,142 dec.), and telegraph and telephone cable and material (£24,145). The only notable increase was that of £3,687 in the electrical glow lamp section. The month's total is, however, £34,157 higher than in June, 1923.

The electrical import figures for the first six months of 1923 and 1924 were:—

Imports	1923.	1924.
Electrical goods and apparatus	£1,105,593	£1,373,879
Electrical machinery	£553,543	£532,695
Totals for six months ...	£1,659,136	£1,906,574

The re-exports of electrical goods and machinery for the month totalled £21,485, a decrease of £3,886 as compared with the previous month, principally due to lower values in the sections for electrical goods and apparatus, electrical machinery, and telegraph and telephone material; as compared with June, 1923, a reduction of £722 is recorded. For the six months to June, 1924, an increase of £20,059 is shown in this section as compared with the same period in 1923.

	Exports.					Imports.					Re-Exports.				
	Electrical exports for June, 1924.	Inc. or dec. as compared with May, 1924.		Inc. or dec. as compared with June, 1923.		Electrical imports for June, 1924.	Inc. or dec. as compared with May, 1924.		Inc. or dec. as compared with June, 1923.		Electrical re-exports for June, 1924.	Inc. or dec. as compared with May, 1924.		Inc. or dec. as compared with June, 1923.	
Electrical goods and apparatus (unenumerated)	£132,511	—	£32,973	+	£3,429	£68,415	—	£13,903	—	£10,024	£5,923	—	£1,718	+	£432
Insulated wires and cables ...	187,643	—	38,989	+	52,487	34,420	—	5,345	+	17,064	6	—	852	—	156
Glow lamps	23,972	—	2,518	—	7,027	11,543	+	3,687	+	1,404	275	—	311	—	42
Arc lamps and parts	838	+	132	—	1,432	1,579	—	265	—	595	581	+	538	+	581
Batteries and accumulators ...	50,448	—	18,473	+	8,119	15,798	+	475	+	10,585	443	+	143	+	443
Meters and instruments ...	31,011	—	16,443	+	3,012	16,830	—	3,158	+	8,553	1,675	+	793	+	1,395
Carbons	1,815	—	199	—	2,627	7,266	—	12,880	+	2,871	74	+	41	—	13
Electrical Machinery—															
Electrical machinery (unenumerated)	153,759	—	88,150	+	30,797	95,626	—	22,142	+	6,607	8,242	—	1,954	—	4,446
Railway and tramway motors	63,993	+	40,728	+	36,815	—		—		—	—		—		—
Other motors and generators ...	148,526	—	43,627	+	23,749	—		—		—	—		—		—
Switchboards (not telegraph or telephone)	5,886	+	82	—	3,192	12	—	1	+	12	111	+	86	+	78
Telegraph and Telephone Cable and Material—															
Telegraph and telephone wires and cable (not submarine)	78,343	—	31,068	+	5,487	6,540	—	4,841	—	2,741	367	+	297	—	275
Submarine telegraph and telephone cable	—	—	26,832	—	51,230	—		—		—	—		—		—
Telegraph and telephone instruments and apparatus ...	146,795	—	46,677	+	1,291	44,674	—	19,304	+	421	3,788	—	949	+	1,281
Totals...	£1,025,539	—	£305,034	+	£98,708	£302,703	—	£78,267	+	£34,157	£21,485	—	£3,886	—	£722
Increase or decrease for the six months ended June, 1924 ...			Exports. + £1,164,478					Imports. + £247,438					Re-exports. £20,059.		

Some of the Exhibits at Wembley.

The Electric Construction Co., Ltd.

(*Stand No.* 36, *Avenue* 10, *Bays* 22-24.)

In addition to the Davey Paxman-E.C.C. 400-kW generating set which assists in providing power in the Exhibition (see ELEC. REV., May 30th, p. 883), this company has a display of industrial electric motors.

Two examples—5-6 h.p. at 1,000 r.p.m., and 10 b.h.p. at 1,500 r.p.m.—are shown as representing the company's new range of small squirrel-cage motors, which are built in sizes of from 1 to 10 b.h.p. These machines embody the following special features. The rotor bars and end rings consist of a one-piece casting of special metal without joints of any description. Ball bearings are fitted, the inner races, which are pressed on to the shaft, being held at one end by a nut and

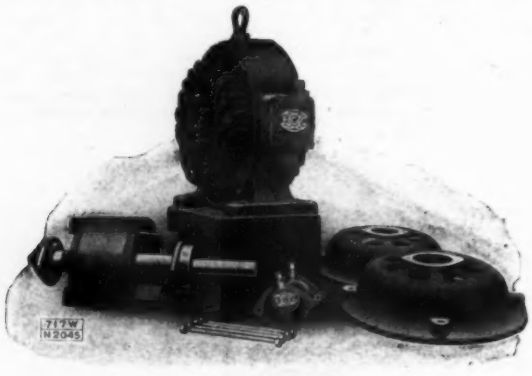

Fig. 161.—"E.C.C." Squirrel-cage Motor Components.

washer and at the other by a sleeve secured by a grub screw. The shaft is reduced beyond the bearing to facilitate the fitting or withdrawal of the ball race. Fig. 161 shows the components of one of these motors, and fig. 162 the complete assembled machine.

A slip-ring motor shown is fitted with a new brush-lifting and short-circuiting device. This is hand-wheel operated, one

Fig. 162.—Complete "E.C.C." Squirrel-cage Motor.

movement short-circuiting the rings and lifting the brushes in correct sequence.

Three machines of the company's latest d.c. interpole range are also exhibited. Either ball or ring-lubricated bearings are fitted. With the latter a special type of housing has been adopted which eliminates the possibility of oil leakage even at high speeds.

The Wallsend Slipway and Engineering Co., Ltd.

(*Stand No.* 143, *Avenues* 2 *and* 3, *Bays* 16 *and* 17.)

Included in this exhibit is a complete oil-burning installation as applied to marine boilers working under forced, induced, and natural draught. The application of an oil burner to the centre of the furnace is also displayed. A furnace is shown fitted with the "Wallsend" steam jet system of oil burning with gravity feed. This is suitable for Lancashire, Galloway, Cornish, and water-tube boilers. Another oil burner with gravity feed and air blower is also exhibited, in addition to other oil-fuel apparatus.

The Micanite and Insulators Co., Ltd.

(*Stand No.* 27, *Avenues* 11 *and* 12, *Bays* 20 *and* 21.)

Numerous classes of insulation for electrical purposes appear on this stand, including mica in every form, micanite, "Paxolin," Empire cloth, silk, paper, tapes, &c., leatheroid, and other materials. The firm's principal exhibit consists of a display of "Paxolin" e.h.p. terminals and bushings for transformers and switchgear, suitable for use under oil at high temperatures and for working pressures of from 22 to 88 kV. Other "Paxolin" products shown are transformer cylinders and tubes. The micanite parts exhibited include commutator "V" rings, separators, &c.

Messrs. Mirrlees, Bickerton & Day, Ltd.

(*Stand No.* 87, *Avenue* 13, *Bays* 5-7.)

The outstanding feature of this stand is a 150-b.h.p., 3-cylinder "Mirrlees-Diesel" engine. This is illustrated in fig. 163, which also shows the small electric motor which is used to keep the engine in motion for demonstration purposes.

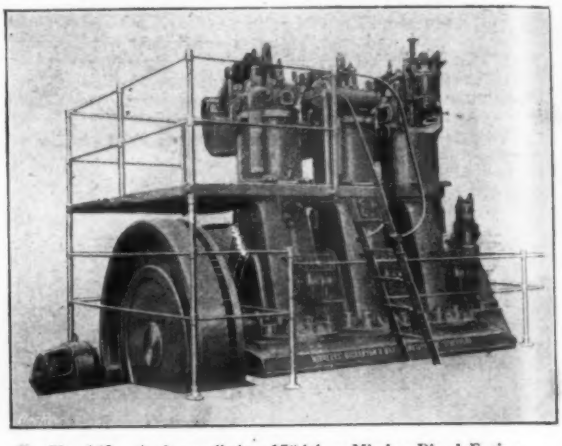

Fig. 163.—A three-cylinder, 150-b.h.p. Mirrlees-Diesel Engine.

It will be seen that the right-hand cylinder has been sectioned at the top to enable the working of the valves to be observed. A fuel pump similar to that employed with the engine is shown in section, as is also a new type of fuel valve which does not require packing, and is so constructed that accurate alignment becomes unnecessary. The fuel injection is by

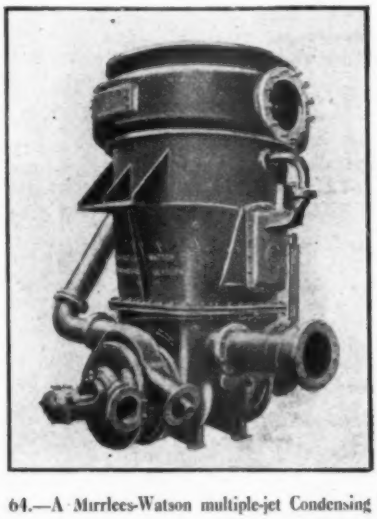

Fig. 64.—A Mirrlees-Watson multiple-jet Condensing Plant.

compressed air, which does not entail such high cylinder pressures as mechanical or solid injection. A forced-feed lubrication system is adopted, and no lubricator is made to serve more than two points.

Another exhibit is a 40-b.h.p. "Mirrlees-Simplex" engine, which is also cut away in parts to show the movements of the internal mechanism.

For the rest the exhibit comprises a number of components and auxiliaries for oil engines.

On the same stand the Mirrlees Watson Co., Ltd., exhibits machinery for the treatment of sugar, centrifugal pumps, and condensing and distilling plant. The exhibits include a patent condensate pump of the two opposed impellers type. The stuffing boxes are always under pressure corresponding to the full discharge head of water, and leakage of air through the boxes when working on the highest obtainable vacuum is eliminated. Another piece of apparatus shown is a multiple-jet condensing plant (fig. 164). This is fitted with a rotary

air pump and centrifugal water extraction pump. Other exhibits are a steam ejector air pump with intermediate condenser and a 10-in. low-lift centrifugal pump, and a high-lift turbine pump.

Messrs. Marryat & Scott, Ltd.

(*Stand No.* 35, *Avenue* 7, *Bay* 5.)

The sole exhibit of this firm is a lift typical of its manufactures. It is capable of carrying six people, and the motor is only of 3.5 h.p. The lift (fig. 165) is capable of making from

Fig. 165.—A Marryat & Scott Electric Lift.

60 to 70 trips with a consumption of 1 kWh. A special feature is the lubrication of the gearing; the gear is completely enclosed and can run for 12 months without attention. For demonstration purposes both switch and push-button controls are fitted. The safety arrangements provided make it impossible for an operator to damage the equipment or injure himself.

The Aster Engineering Co. (1913), Ltd.

(*Stand No.* 71, *Avenue* 4, *Bay* 24.)

The main exhibits shown by this company are three marine oil engines of 10, 27/30, and 45/52 b.h.p. respectively. In addition to these three generating sets are on view. The largest is a 16-kW self-contained set driven by a 28-h.p., 4-cylinder oil engine. This is designed for emergency ship

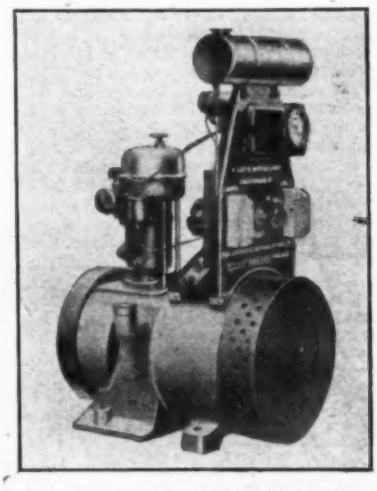

Fig. 166.—The "Aster" 1-kW Lighting Plant.

lighting, for wireless services, bilge pumps, &c. Another set exhibited has an output of from 6 to 8 kW, and consists of a generator and a directly-coupled engine upon one bedplate. It is suitable for kinematograph purposes, or for large country houses. The third set has an output of 1 kW, and is a very compact plant, as will be judged from the illustration (fig. 166). The water-cooled engine and the compound-wound 4-pole generator are housed in one casing, and upon this are mounted the cylinder with removable head and an aluminium switchboard. Above the last is mounted the petrol tank. The generator is wound for either 25 or 50 V. A battery of 13 accumulators with a capacity of 170 Ah forms part of the equipment.

The other exhibits include the "Anthony" automatic feed-water regulator, the principal part of which is a float-operated valve; and the "Aster" remote level indicator. The latter can be used on boilers and storage tanks.

Messrs. John Dugdill & Co.

(*Stand No.* 137, *Avenue* 15, *Bay* 5.)

A large collection of movable-joint fittings for lighting and other purposes is arranged on this stand. The examples include standards, wall and pillar brackets, pendants, picture lighting fittings, travelling lights, spot lights, &c.

British Engine, Boiler and Electrical Insurance Co., Ltd.

(*Stand No.* 130, *Avenue* 15, *Bays* 15 *and* 16.)

At this stand the company's representatives give advice regarding the working of power plant, and an associated firm, British Electrical Repairs, Ltd., shows a vacuum impregnating plant for the treatment of the coils of electrical machinery.

Messrs. Stuart Turner, Ltd.

(*Stand No.* 203, *Avenue* 1, *Bays* 25 *and* 26.)

This firm is exhibiting a .5-kW lighting set which is used for the illumination of the stand. It consists of a d.c. generator directly-coupled to a 1-b.h.p. petrol or gas engine fitted with a ball and roller-bearing crankshaft, and running at 1,200 r.p.m. The set is equipped with a slate-panel switchboard, on which the necessary instruments and controls for

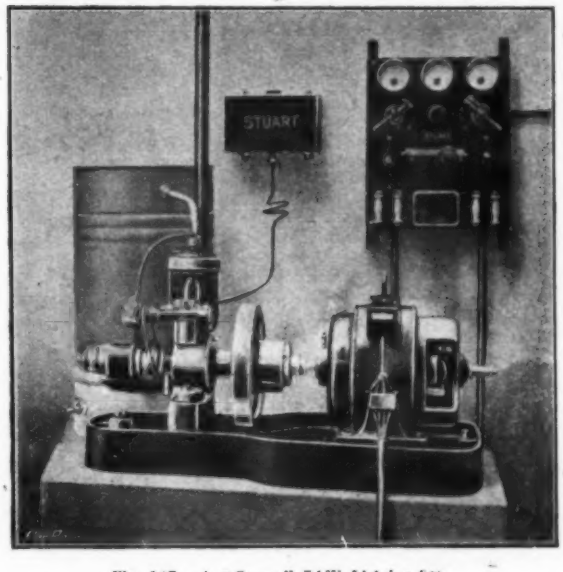

Fig. 167.—A "Stuart" 5-kW Lighting Set.

the generating plant and battery are mounted. The battery has 14 cells, and is rated at 100 Ah. The set and switchboard are illustrated in fig. 167. In addition to this there is a compact 120-W lighting set suitable for small cottages, house-boats, yachts, &c. The prime mover is a small two-stroke engine. A small switchboard and a 50-Ah accumulator battery are provided, and the equipment is arranged for operation by unskilled labour. The firm also shows a .75-b.h.p. gas or petrol engine, and a number of working models of engines.

The Lamplough Day Lamp, Ltd.

(*Stand No.* 142, *Avenue* 15, *Bays* 9 *and* 10.)

This company shows a number of examples of its artificial daylight units (the "Sheringham" type) which attain their object by means of a specially coloured shade-reflector which absorbs red and yellow rays. Among the examples are the 200-W and 500-W industrial models which find their principal application in the colour-matching departments of textile factories. Other types shown are suitable for general illumination, and there are trough models for localised lighting.

Messrs. Attwater & Sons.

(*Stand No.* 274, *S.E. Block*, *Bay* 24.)

The insulating materials displayed by this firm include bakelite, micanite, mica, ebonite, &c., in rod, tube, and sheet forms, as well as numerous moulded and manufactured parts. There are also examples of insulating tapes, asbestos and cotton products, varnishes, and moulding powders.

The Incorporated Municipal Electrical Association.

Annual Convention at Chester.

(*Concluded from p. 53.*)

Performance Guarantees for Power Plant.

By J. N. WAITE, M.I.E.E.

(*Abstract.*)

IN this country the design of power plants for the supply of electrical energy has settled down for the present to coal-fired boiler, steam-turbine driven, three-phase generating plant, with surface condensers. This paper concerns itself only with the main items of the foregoing type of power plant, and has been written entirely from a purchaser's point of view.

The subject matter of the paper is the result of experiences in connection with the carrying-out of official acceptance tests, and in attempting to draw up guarantee schedules for power plant specifications, which would ensure that with a properly-conducted acceptance test, no difficulties would arise in determining, within close limits of accuracy, whether the guarantees given were fulfilled or not.

Power plant performance is affected by the design, and also by the conditions. Some of the conditions can be fairly easily controlled, some are difficult to control, while some are not susceptible to control at all. As it is impossible to ensure that any definite exact value for any of these conditions will be exactly obtained during the official acceptance tests, the value of the conditions that affect power plant performance becomes important to purchasers. An example of the importance of accurate knowledge of the value of conditions is given in the following table:—

	Case 1.	Case 2.
Actual terminal pressure in.Hg. abs.	1.36	1.0
Actual steam consumption, lb./kWh	10.93	10.83
To correct to 1.0 in.Hg. abs. deduct lb./kWh	0.26	0
Actual consumption reduced to 1.0 in.Hg. abs., lb./kWh	10.67	10.83
Guaranteed steam consumption at 1.0 in.Hg. abs., lb./kWh	11.00	11.00
Improvement on guarantee, lb./kWh	0.33	0.17
Tolerance margin deduct, lb./kWh ...	0.11	0.11
Net improvement on guarantee, lb./kWh	0.22	0.06
Bonus earned (£500 for each complete 0.1 lb.) ... ... £	1,000	0

This example is not a hypothetical case, but is founded on an actual case in connection with the official acceptance tests on a turbo-alternator. It will be seen that, if the inaccurate correction value had been used—the value in question being the effect of terminal pressure on turbine steam consumption—the purchaser would have paid £1,000 in bonus for the set, which had not actually been earned.

The conditions which affect the performance of power plant can be divided into two groups for the purpose of this paper. These are:—

(*a*) Conditions which have values peculiar to the design of the particular plant.

(*b*) Conditions which, within defined limits, have a value generally applicable to all classes of similar plant.

For correction purposes the only logical way of dealing with conditions that have values peculiar to particular plants is to determine the actual value from actual tests on the actual plant concerned. The author advocates that this should be provided for in the guarantee schedule.

For correction purposes the group of conditions which have values generally applicable can be dealt with by incorporating in the guarantee schedule the value to be used. To enable this to be done it is necessary that the values of the conditions concerned should be determined from actual tests, and should be settled and agreed to by some authoritative body. The paper gives a number of test data to this end.

It may with advantage be emphasised that manufacturers cannot obtain test data from large-sized power plant at their own works. Accurate data from such plant can only be obtained after the plant is installed, and therefore it is up to the supply industry to obtain such data, either alone, or in co-operation with manufacturers.

At present two calorific values are in use: the gross calorific value represents the true heat value of a fuel, and is actually realised in a calorimeter, and the author urges that the gross value should alone be used in determining boiler efficiency. He has adopted 3.0 per cent. of the calorific value of the fuel as the average radiation loss and 1.0 per cent. for the unburnt fuel loss as standard figures for the calculation of coal-fired boiler efficiency. It would appear possible to develop tables connecting final exit gas temperatures with efficiency, to cover the usual range of variables in coal; the influence of feed-water temperature on final gas exit temperature could be authoritatively defined. A boiler guarantee schedule is put forward for discussion. Correction curves are given for the effect of different values of superheat on steam consumption, and the author suggests that agreed values should be defined by an authoritative body or bodies. The effect of interheating can be stated approximately by using the value of superheat at the stop valve as the criterion of value.

Variation of initial steam pressure affects the steam consumption differently in accordance with the system of governing employed. For plain throttle governing the effect can be readily laid down, if the overload valve is closed. With nozzle governing similar corrections can be made.

In dealing with vacuum the author would adopt the term "terminal pressure." Variations in this value have different effects on the performances of different turbines, and values generally applicable cannot be laid down; corrections should be based on test results for the particular turbine concerned. Values cannot be prescribed for the effect on steam consumption of "bleeding," which varies in each case. The usual tolerance margin on steam consumption is 2.5 per cent.; the author suggests that it should be 1.0 per cent., and should not be increased when the corrections applied exceed 5 per cent. Temperature tests on alternators taken with thermometers after the machine has come to rest are meaningless; the temperature of the rotor should be measured by its resistance whilst running, and that of the stator by means of thermo couples embedded in the windings.

In testing alternators, if the full economical load has been carried long enough for the maximum temperatures to be attained, a run of one hour, in the author's experience, at the full overload output is sufficient to reach the full temperature rise. The inherent regulation clause should be amended to include the inevitable rise in speed that occurs when full load is thrown off. A series of amended clauses for turbo-alternator guarantee schedules is put forward.

With regard to condenser performance, practice is fairly well standardised and it should be possible to arrive at agreed values for variation of conditions in acceptance tests. The author holds that condenser guarantees should be based upon condenser "K" (B.th.u. transmitted per sq. foot of cooling surface per hour per mean degree difference between steam and water), in conjunction with the absolute pressure produced, but he does not incorporate this suggestion in the proposed schedule which he outlines.

For cooling towers he puts forward a schedule covering the usual range of temperature of the atmosphere and of the cooling effect, and in a following section he points out the financial importance of accurate correction values, as exemplified in the table given above, and in an actual condenser performance guarantee schedule. Finally, the author criticises published test results in general, and suggests that all official acceptance tests shall be carried out by an independent authority.

The paper, which occupies 90 pages, includes 20 graphic curve diagrams and 14 tables.

Discussion.

Mr. I. V. ROBINSON (B.E.A.M.A.), said he would be expressing his own views and in no way committing the B.E.A.M.A. As to the calorific value of fuel, he had been asked by Captain Sankey, the chairman of a joint committee of the leading engineering institutions, to say that a sub-committee was dealing with boilers, and a recommendation had been made that the gross value should in future be adopted. With regard to the statement that it was preferable that all corrections used for variations in conditions for turbo-alternator guarantee schedules should have an experimental basis, it was the fact that the difficulties put forward by the various manufacturers were based on experience over a number of years with various turbines, and he did not agree that under all conditions, with the same turbines, even, the same rate of correction would be arrived at. He disagreed entirely with the author in his statement that the proper tolerance margin for turbine test results should be plus or minus 1 per cent. He did not see how the tolerance could be less than the usual 2½ per cent. He also disagreed entirely with the author's suggestion that there should not be an addition to this margin under certain conditions, because it was impossible to get the same conditions in every case. When the author referred to certain suggested alterations in the turbo-alternator guarantee schedules, he could not have been aware of the many months of discussion that had taken place between the B.E.A.M.A. and the I.M.E.A., and he did not think that many of the points made in the paper would have been pressed if the author had been present at those discussions. The author was right in suggesting a new clause covering emergency trip speed. He challenged the statement in the paper that the design of condensing plant was so settled and standardised now by the different firms that similar plant was put forward in competing tenders. A comparison of such tenders would show this to be far from the case. The suggestion for a modified form of air leakage guarantee was a good one and might, perhaps, be incorporated. The condensing plant manufacturer did not desire a margin of vacuum. He guaranteed

a certain vacuum with a certain load, and that was what he had got to deliver. Therefore he thought the suggested margin of 2½ per cent. on the terminal pressure was a mistake.

Mr. M. WADESON said that the main consideration from the point of view of testing was the need for a clearly drawn up specification as to requirements, giving in sufficient detail the performance to be accomplished by the plant. After many years of experience Mr. Selvey and himself had found considerable difficulty often occurring through lack of detail in the specification. On the other hand, frequently requirements were called for which could only be met under special conditions, and the conditions mentioned throughout the paper seldom, if ever, occurred all together at the same time. He thought standards could be evolved without interfering with the manufacturer's freedom to acquire merit through the performance of his apparatus, but design had by no means reached finality and the manufacturers must not be restricted so as unduly to hamper progress. The inclusion of the exit flue gas in the case of boiler tests was an improvement from the point of view of the testing engineer, because efficiency depended not only on the calorific value of the coal but also on its nature. With coals of equal calorific value, unburnt fuel loss might vary, dependent neither upon bad firing nor any fault of the grate, but on the nature of the ash content. A low-temperature fusing ash forming a soft clinker of pasty consistency which grew rapidly, would carry off more unburnt fuel than larger quantities of an ash forming hard clinker. The order of accuracy asked for by the author needed careful and special precautions. He agreed with Mr. Robinson that there were large variations in design of condenser plants tendered for, for the same work. He had, for instance, seen figures of plants with nearly 30 per cent. less cooling surface giving equal results under similar conditions.

Mr. R. B. MITCHELL (Glasgow) agreed that the gross calorific value should be adopted. The author's additions to the specifications with regard to guarantee clauses seemed to make the conditions unnecessarily elaborate. The information asked for by the author could be got under ordinary running conditions, and if the boiler maker gave definite guarantees for the boiler at full load and overload, this seemed to him to be sufficient for the protection of the purchaser. In the case of turbo-alternator specification steam consumption clauses, the special test suggested in the paper seemed to him rather difficult, as any steam consumption test would have at least three variables: steam pressure, temperature, and terminal pressure. It would be an advantage if steam consumption guarantees could be given with tolerances on all three variables. This would give a figure which would be of more use in general running conditions and would make the systematic testing of plant during its life a comparatively easy job. In most cases where several sets had to be run to carry the station load, all the sets with the exception of one would be run at economical load, and a slight alteration in efficiency due to running off the economical load of the one machine which was carrying the variations would have a very slight effect on the efficiency of the whole station. It was very desirable that they should have a set of standard corrections.

Mr. F. F. EVANS (Underfeed Stoker Co.), said he did not know of many cases of unburnt fuel loss of only 1 per cent. in ash. Two per cent. was usual when dealing with various classes of coal and mixtures of coal and coke breeze. Some time ago there was a very heated controversy in connection with the guarantees of specific performance of a plant then being put down at the works of the Central Electric Supply Co. in London. The guarantees were from 89 per cent. on the gross calorific value of the fuel. This plant had been at work for some time now, and tests taken not in the presence of the contractors showed an efficiency of 90.7 per cent. on the low calorific value of the fuel and 86.7 per cent. on the high calorific value of the fuel. These efficiencies were net, and they were extremely good and remarkable figures. From this point of view, he found it very difficult to see how the claims for powdered fuel could be justified at the present time. Now, certain types of boiler were being set higher, and in the case of the Central Electric Co. it seemed likely that the boilers would be set 3 ft. or 4 ft. higher still. In that event he anticipated an increase in efficiency of another 1 or 1½ per cent. His company was engaged in putting in powdered fuel plant to two varying sizes of boilers. One was for boilers of 40,000 lb. evaporative capacity per hour, and the other was a boiler with an evaporative capacity of 101,000 lb. One of the strong points in connection with powdered fuel was the possibility of increasing station capacities on the existing area occupied by the boilers. The 101,000 lb. boiler plant was being installed by the North Metropolitan Electric Power Supply Co.; the boiler had a heating surface of 7,200 sq. ft. and was 16 ft. wide. Comparing this with existing types of boiler fired by stokers, it would be found that a boiler for the same duty would have to have a heating surface of 11,000 sq. ft. and be in the neighbourhood of 30 ft. wide. Thus, if the claims made for powdered fuel were correct, there would be a considerable reduction in the area occupied by boiler plants for the same output.

Mr. R. A. CHATTOCK (Birmingham) confined his remarks chiefly to cooling towers, and in reply to a suggestion made by Mr. Robinson as to carrying out tests in conjunction with the manufacturers, expressed his willingness for his staff to do this if the manufacturers would supply the necessary instruments. Such information he believed would go a long way towards stabilising the design of cooling towers, to a very much greater extent than was the case at present. The guarantee performance of these towers was now very much more satisfactory than it used to be. He did not agree with the author in his opinion as to the effect of humidity. In his suggestion for a schedule of guarantees for cooling towers, the author started from a basis of the inlet temperature of the water into the tower and then asked for figures of the temperature of the water leaving the tower under different conditions of wet bulb thermometer. A better way to tabulate that would be to assume a fixed inlet temperature and plot the final temperatures over various quantities of water passing through, because it was difficult to maintain the quantity of water passing through at a constant figure, whilst it was easy to control the inlet temperature and keep that constant. The final temperature figures would then be given for a series of humidity figures and these could be plotted on curves, any intermediate conditions under which the test was actually carried out being easily transcribed on the curve. Then it would be seen at once whether the guarantee figures had been obtained. He had developed that system in connection with the Birmingham towers and it had worked very satisfactorily, although there was some difficulty originally in measuring the final temperatures. It was also advisable to make tests under different conditions, because the performance of the towers varied considerably as between mid-winter and mid-summer.

Mr. C. H. YEAMAN (Stoke-on-Trent) said he agreed, of course, with everything in the paper, and appealed to chairmen of committees, after they had read it, to appreciate that when testing plant was asked for, it was not toys that were wanted. As to final acceptance tests, although in most stations the staff were qualified to carry these out, he did not think it fair to ask the staff to make the tests upon which they would finally be judged. Therefore, he advocated such tests being carried out by an independent authority.

Mr. W. A. A. BURGESS (Reyrolle & Co.) said that the figures in the paper with regard to boiler efficiency, and also those mentioned by the representative of the Underfeed Stoker Co., related to high-class coal, but everybody could not use such fuel except on peak loads. At other times they were forced to use very low-grade fuels, but the use of such fuels would upset the figures obtained as test figures, and then it was necessary to get out a complete new set of test figures. He knew a station where fuel costing £1 per ton was used at peak loads, and coke breeze costing 5s. to 6s. per ton was used at periods of light load. Under light-load conditions the efficiency was of the order of 56 per cent. on the boiler and 65 per cent. for the whole combination, but the fuel used cost one-quarter of that used at peak-load periods.

Mr. T. ROLES (Bradford) said the question of temperature rise of alternators was being considered by the Standards Committee. In the case of machines of, say, 20,000 kW running at 3,000 r.p.m., it had been found necessary to use very much higher temperatures if satisfactory machines were to be obtained, from the mechanical point of view. If the machines would not stand up to these higher temperatures, then the use of machines running at 3,000 r.p.m. would be limited. The curve in the paper, fig. 15, was most valuable with regard to temperature rises, for the reason that the author had been fortunate enough to have machines containing embedded temperature detectors, so that in the stator of the machine it had been possible to find out what the actual temperatures were whilst the machine was running. Formerly, although manufacturers inserted embedded temperature detectors, they had been careful, at any rate in his own case, to disconnect them before the machine was handed over. Although at one time the manufacturers would not give guarantees with the detectors in use, they were now willing to do so. The advantage of these detectors was manifest, because it would be found that, without them, when the machine was shut down and temperatures were taken with a thermometer, before the temperatures could be taken the hot spots had become cooler and the colder parts had become hotter, so that the results were no criterion as to the actual running conditions.

Mr. P. E. RYCROFT (Babcock & Wilcox, Ltd.) said his experience was that the author's figure of 3 per cent. for radiation loss was too high for high duty and high-power boilers, and 2 per cent. would be nearer the mark. With regard to the variation in moisture content of British coals being from 3 to 20 per cent., his experience was that although such a variation was possible, it was very rarely found in the same district. Anything which tended to standardise the specification was bound to be a good thing for both the manufacturer and the purchaser.

Mr. J. P. GREGORY (B.T.H. Co.), speaking on the subject of tolerances on steam consumption, said he was certain that when the matter was considered in all its bearings the present practice would be found to be justified. Reference was made in the paper to individual nozzle governing as being theoretically the most economical, but that in practice this advantage was not realised. It would have been very interesting if the author could have given some actual data in that connection, because very little had been published. He agreed with the author that it was better to have independent tests made for the final acceptance. These very accurate tests should not be confined to the large plants alone, and if results were to be obtained of a reliable character in every case it would be better to have the testing done by men who made it their every-day work.

The Industrial Position in Sweden.

IN the opinion of Mr. H. Kershaw, Commercial Secretary at Stockholm, if British manufacturers would act with real vigour and enthusiasm, much more rapid progress would be made in developing British trade in engineering products in Sweden. This country occupies a very favourable position in the matter of quality and reliability of deliveries, and he considers it surprising that, in view of the present disabilities from which Continental industries are suffering, our engineers have not been more successful in the Swedish market. The handicap which they have suffered, owing to depreciated exchanges, is estimated at about 20 per cent. It is true that competition is very keen, not only from the Germans, who are making every possible effort to regain their foothold in a former remunerative market, but also from Czecho-Slovak firms.

There is much that is encouraging in the general business outlook in Sweden. Mr. Kershaw, in his report to March last (D.O.T., price 1s. 6d.), says that the country, in spite of many adverse factors, such as exchange, high wages and railway freights, succeeded in maintaining a steady stream of exports. At the same time, her manufacturers are becoming more and more impressed with the desirability of establishing branch works abroad. This policy has been followed in the telephone, ball-bearing, and other industries. Swedish engineering shops profited by the weakening of German competition, not only within Sweden itself but in foreign markets. It is pointed out that the Government's policy of declining to accede to every request for increased protection of specific industries has on the whole resulted in strengthening the economic fabric by eliminating weak industrial concerns and by reducing prices. Unless some unforeseen circumstances arise, a progressive strengthening of the economic position is expected.

Some Criticisms.

Although Mr. Kershaw appears to be rather critical of the commercial methods of British engineering industry, he records a gradual improvement in our trading methods generally, and a better conception in Great Britain of Sweden's requirements. He thinks this tendency should be accelerated because there is an incontestible preference for business relations with British concerns. He believes it is not yet clearly understood that the exchange advantages which many countries in Europe enjoyed 12 or 18 months ago have been gradually disappearing. Swedish importers have learnt the advisability of going where reliance can be placed on delivery, quality and price. The present time is therefore considered an exceptionally favourable opportunity for our manufacturers to develop the Swedish market.

Mr. Kershaw makes a few practical comments on trading methods. For example, he asks that agency applications from obviously sound Swedish concerns should be treated with very careful attention. He records that a serious inquiry once elicited nothing more than a catalogue fourteen years old without prices. On these lines, he remarks with justification, business would be a painfully slow process. There is too general a tendency on the part of British traders, he says, to force the importer to declare all manner of details before prices and terms are quoted. Mr. Kershaw considers that the importer should be interested or tempted by submitting designs and samples. Very noticeable, too, is the British habit of over-estimating the effect abroad of the date of the foundation of a firm.

Electrical Trade.

A favourable factor in Sweden's engineering industry last year was the considerable number of orders for electrical material placed by Government Departments. Towards the end of the year, works turning out motors, paper-making machinery, mining implements, and the like had orders in hand for several months. Among the principal exports were electrical generators, motors, to a total value of Kr. 12,709,500, compared with Kr. 10,877,000 in 1922, whilst exports of telephone and telegraph apparatus were Kr. 8,183,500 in value, compared with Kr. 8,278,000 in 1922.

In summarising the progress of Swedish railway electrification schemes, the Commercial Secretary gives some particulars of the Svartön-Riksgränsen-Narvik line, which is described as the longest electrified line in Europe.

Hydro-electric Power.

Mr. Kershaw gives a short but interesting survey of Sweden's water power and the extent to which it has been developed. It is estimated that the total energy available from waterfalls in Sweden amounts to about 6,000,000 h.p., of which some 4,500,000 h.p. is owned by municipalities and private concerns. Of this amount about 1,322,000 h.p. has already been developed, and work is in progress for the harnessing of a further 90,000 h.p.

Telephones and Telegraphs.

By reducing the tariff for inter-urban telephone calls, the Swedish authorities have brought about an increase of 10 per cent. in receipts. On the other hand, telegraphic receipts fell off 5 per cent. The receiving section of the large Swedish Government wireless station on the west coast was completed and tested at the beginning of 1924. Rapid progress was made in Sweden during 1923 in the sale of broadcasting appliances.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Hindrances to Electrical Development.

I was keenly interested to read Mr. R. A. Williams's letter in your issue of the 11th inst., because he has voiced exactly my own opinions.

At a recent E.D.A. meeting at Leeds, I particularly mentioned two factors as being responsible for the lack of growth in demand for electricity supply, namely, the fact that electrical engineers do not use electricity sufficiently in their own homes, and secondly, that the high cost of the apparatus is partly responsible for this state of affairs.

Unfortunately, electrical engineers in general are very poorly paid, and cannot afford to pay for all the apparatus which is necessary to complete the "All-Electric Home."

Some means should be adopted by the employers, be they owners of electricity works or directors of manufacturing companies, to encourage their staffs to equip their homes throughout electrically.

For one thing, electrical engineers cannot talk sincerely about the advantages of electricity in the home, if they have not had the experience, and also they cannot expect the public to take it up more if they do not set a good example themselves.

The E.D.A., while doing very useful work amongst the electrical fraternity, might do much better if it advertised more by means of large hoarding advertisements, appealing directly to the small user or the non-user of electricity.

A. E. Jepson.

Sheffield, *July 14th*, 1924.

Your correspondent "R.B.D." says:—

"It should be a very simple matter to determine the number of units per quarter that can be reasonably used for lighting houses, and after that number of units has been consumed, the charge should be reduced to the power rate."

The matter is so simple that it has been thought of many times, but the hesitation of undertakings to adopt the principle shows that there is a difficulty. The theory of the idea is perfect; but in my opinion, it would be very imperfect in practice, and the cause of great dissatisfaction.

It seems so easy for the supply authority to fix a minimum number of units per house at lighting rate, and so easy for the consumer to add all kinds of apparatus to his existing circuit, to consume extra units at a cheap secondary rate. But let us look carefully at the proposition.

Suppose "R.B.D." to live in a house of moderate dimensions and to consume 200 units a year. At 6d. per unit his yearly account would be £5. Probably a heating and cooking rate would be available at 1½d. to 2d. per unit, and to take advantage of this he would necessarily be obliged to run separate wiring to a meter at the low rate, but new wiring would be necessary in any case, for the meagre flexibles run by the modern wiring contractor would not be safe for a radiator of any size. If his intention is only to utilise irons, toasters, kettles and shaving-water heaters, the consumption of these is so small that the lighting rate for all of them should not be expensive. It can also be remembered that the more use he makes of these accessories the better load factor he is giving the authority and the quicker it will be able to reduce the lighting rate all round.

Next door to "R.B.D." in the same type of house, we will assume that "X.Y.Z." is the occupier. The latter lives in the bottom half of the house, and decides to let the top half. Under the system proposed by "R.B.D.," who pays £5 for 200 units, his next-door neighbour will pay £6 9s. 2d. for 400 units (assuming that the secondary rate is 1½d.) instead of £10. The deficiency will be shared by "R.B.D." and the other consumers, and the result will be to stop reductions in tariffs that would otherwise be shared by all consumers in proportion. The maximum demand of "X.Y.Z.'s" house on peak load would be double that of "R.B.D."

It would appear that, in most undertakings, to offer a concession of this kind would turn a profit into a loss immediately, for every consumer who already takes over the minimum number of units to be fixed would clamour for the new rate and would take the benefit of the reduction, without any certainty of the supply authority getting recompense in a larger use of electricity.

If a consumer is really anxious to use electricity for purposes other than lighting, the cost of an extra circuit will not prevent him from taking advantage of a cheap heating rate through a separate meter.

There is a very wide divergence in the number of units consumed for lighting in similar houses in the same road. In a road of 14 houses taken out recently, the yearly number of units at lighting rate ranges from 82 to 298. In another road, 38 houses, from 63 to 363 units. It will thus be seen that should a certain number of units be charged at lighting rate and the remainder at heating rate, the *total* revenue from these accounts would be lessened to such an extent as to make it almost impossible to recoup the loss by any possible increase in consumption.

The cost of an extra meter to the supply authority does not amount to a great sum when spread over the number of years of useful service given by a meter of good make, and in most cases (municipal, at any rate) no rent is charged.

As regards the "push" and "enterprise" of the gas companies, "R.B.D." may, or may not, know the restrictions that are placed upon municipal authorities' staffs from exercising their enterprise; he may not know that without special Parliamentary powers a municipal electrical undertaking cannot even wire a house, except by giving the job to a wiring contractor, nor even sell a consumer a piece of apparatus.

To get over the difficulty of supplying houses that are only rented, a hiring scheme can be adopted to wire houses for both lighting and heating on separate circuits. This frees the tenant from any capital outlay at all, and he can leave the house without incurring any liability other than for the rental of the wiring for the time he uses it. One can understand the "push" and "enterprise" of the gas companies in installing slot meters for gas especially for gas cooking; the resultant profits are no doubt very large, for the more gas the consumer uses, the more is paid for the hire of apparatus.

A.W.H.S.

July 18th, 1924.

Pulverised Coal.

With regard to the controversy that has been taking place in your columns concerning the amount of ash discharged from the chimney in the case of pulverised-fuel firing, one becomes completely tired of contradicting statements which are so utterly silly, that it is almost incredible that self-respecting engineers should continue to make them.

There are only two plants in the world where any accurate tests have ever been carried out on the actual amount of ash that is discharged. These are the Lakeside plant at Milwaukee, where the figures showed 15 to 25 per cent. of the ash discharged, and the Oneida Street plant, Milwaukee, where tests by the United States Bureau of Mines showed 29 per cent. on an installation which was not originally intended for pulverised fuel. These figures correspond very roughly to 3 per cent. of the weight of the coal, and in the first place are probably no more than those being given by hundreds of mechanical-stoker plants.

The best detailed information with regard to this ash question is in a recent paper by Mr. H. D. Savage, read before the American Society of Mechanical Engineers, and there it is shown conclusively that what ash is discharged is in such an extremely fine condition, and is spread over such a vast area, that it gives no more trouble than specks of dust or particles of salt in the atmosphere. As a matter of fact, the particles of ash are so excessively fine that if it were not for the rain they would remain floating in the air almost indefinitely, and what happens in practice is that they are washed down by every shower.

The elementary fact remains that with the several million tons of coal now being burnt per annum in the United States in steam boiler plant, there is no trouble with the ash, nor has there ever been with any modern system of firing at all, and for a number of engineers therefore over here to go on talking about what might happen theoretically is childish. We can assume that the people responsible for some of the greatest and most efficient power plants in the world, such as the Ford installations in the United States and Canada, the Cahokia plant at St. Louis, the Detroit Edison Company, the Cleveland Electric Company, the Colfax Station at Pittsburgh, and many others may possibly be mistaken in the question of pulverised fuel *versus* mechanical stoking, but they are not abject idiots, which would be the case if they had put down millions of pounds' worth of pulverised-fuel plant which emitted nearly all the ash from the top of the chimneys and deposited it over the immediate neighbourhood. It is really time that a number of engineers in this country brought some elementary common sense to bear on their consideration of this question of pulverised coal, and really many of the objections that have been raised to it—whilst, of course, having their humorous side—are at the same time not very creditable, to say the least of it, to British engineering.

David Brownlie.

London, *July 16th*, 1924.

Is Engineering Worth While?

At the present time the advertising "profession" is being largely boomed as the thing of the moment. A while ago quite a lot of people were making fat incomes by inducing the unwary to embark on a course of salesmanship as a certain and lucrative career. Such a career has been the last resort of numberless qualified engineers who, after the war, could not find openings. Some are travelling in oil, some in stationery, and even in ladies' underwear.

My own experience may prove interesting and perchance amusing:—After leaving the Service I tried to get employment, but, being strange and in a strange place, did not succeed, although assisted by the Appointments Department of the Ministry of Labour. There were no vacancies in any branch of engineering, whether due to bad trade or because posts were snapped up during the war I cannot say; the bare fact remains—there was not a job for a qualified and experienced engineer to be had anywhere.

In the circumstances I decided to become a "representative," and by dint of much advertising managed to secure certain agencies. Equipped with nothing better than common sense, optimism, many years' engineering experience, and fairly good health—but lacking a diploma in salesmanship—I sallied forth to deliver the goods. Many young men, now about to leave technical colleges, will be compelled to walk in my footsteps (or go farming), because in engineering the output of trained engineers exceeds the demand, and for their benefit I would remind them that for an unknown traveller breaking new ground certain attributes are essential. One must have the cuticle of a petrified icthyosaurus, the plausibility of a professional politician, and the optimism of a Micawber; add to this the mind of the hardened criminal whose finer feelings have been blunted by repeated convictions, and our hero is equipped "for the road."

In my own experience I have been fairly fortunate, but on one occasion I called upon a magnate (of gutter origin) who greeted me as though I were trying to borrow a dollar, and, without giving me an opportunity of showing I was working for his benefit more than my own, curtly informed me that there was nothing doing. This interview, which lasted 20 seconds, was before certain employés, and I left the room with my tail down feeling like a defiled and mutilated Mahommedan. This instance is interesting because the person in question has entertained me at his house many times, and I have partaken of his salt—when it was scarce; all of this goes to show that there is no sentiment in business.

Readers may ask what I am "getting at," and my only excuse is to let the younger end have the benefit of my experience. Engineering is a rough road, dirty in the beginning, and cruel as one gets older. With wages at the present rate the trained engineer now coming on cannot be expected to remain in the workshop; at the same time, the prospects as a representative are infinitely worse.

Putting the whole matter in a nutshell, I would ask: "Is engineering worth while?" My answer is an emphatic "No!"—until the general status and remuneration are raised. In the meantime a lot of us must struggle on, earning less than the dustman, the policeman, or the postman.

A.M.I.E.E.

July 15th, 1924.

Insulating Tape.

As a large purchaser of adhesive insulating tape, I have found by careful comparison that even in the best grades supplied by different makers there is a great discrepancy in the lengths supplied in rolls of identical weight.

I have come to the conclusion that to purchase by weight alone is absolutely absurd. This practice leads to the use of all sorts of compositions designed to increase the weight of the tape, but having no useful purpose whatever except to increase the profits of the manufacturers; further, the lead foil and paper formers seem to get heavier and heavier as the years go by, and from present indications I feel quite certain that one day deliveries of insulating tape will consist of lead foil, paper, and pitch—the cotton and rubber having decided to give up the unequal battle.

For the future I intend to insist that all tape purchased by me shall have a *guaranteed length in each roll*, and it would be to the advantage of all important users to do likewise. Manufacturers can give lengths with more accuracy than they can give weights if they desire to do so. In fact, I should much prefer to make all purchases by length alone.

I am of opinion that if the matter were taken up with sufficient energy the makers of the best qualities of tape would be only too happy to supply their goods by the yard—it being to their decided advantage to do so.

A. J. Collins, A.M.I.A.E.

London, *July 17th*, 1924.

Maximum Potential Gradients.

In Mr. Llewelyn B. Atkinson's very valuable paper on the subject of cables, contributed at the World Power Conference, remarks were made—though I am sure they were not made with that object—which might lead one to imagine that every effort to meet the conditions in extra-high-pressure cables by seeking to distribute the maximum potential gradients through the cable, was based upon insecure, or at least, questionable, premises.

I quite believe that what Mr. Atkinson had primarily in mind were the attempts which have been made—whether by introducing different impregnating substances into the paper at different distances from the copper core, or whether by using materials having different dielectric constants—to make the potential gradients more uniform through the cable. Moreover, the allusions which he made during the discussion to the fact that cables having copper cores of small diameter had stood up without breakdown to dielectric stresses which, calculated according to the recognised formulæ, must have been very considerable, need not, I submit, cause any misgiving.

In whatever degree practice seems to depart from theory as regards these effects on very small copper cores, the departure is all in the direction of what I may call the "safe" side.

Hence, it follows that if, as I have done, cables are calculated out on the basis of making the maximum potential gradient a quite reasonable amount and one that is known to be safe with larger cables, no worse result will obtain than what has already been found, *viz.*, that the cable will do its work excellently.

The point which, however, I desire to emphasise, is that when we come to single-core cables intended for, say, 130,000 volts in which the makers have reached absolutely the limit of depth to which they can satisfactorily impregnate the insulation, whether those cables have been designed on the maximum-gradient theory or the average-gradient theory is of no moment as regards further progress. The fact remains, that in any case the makers have reached the limits to which they can impregnate.

If, now, it be granted that it is possible to take away the cable at this stage, before the lead sheath is put on, and to introduce two "intersheaths" in the way that I propose to do for the "Hexaphase" system, and if these intersheaths are of such a large diameter that there is a comparatively small difference between their minimum and their maximum stresses, *then a great gain has immediately been made*, quite above any challenge whatever.

The whole point at issue is whether the central insulation of the cable can be made to withstand two separate impregnations. The cable to which I alluded the other day proves conclusively that this can be done; it also proves that these intersheaths may each be of the order of thickness of 0.3 in. and that they can withstand some 35,000 volts apiece; which multiplied by $\sqrt{3}$ gives 121,000 volts of transmission. This has been added to the original 130,000 volts, after the single-core advocates have confessedly reached the end of their tether, by the simple expedient of the two intersheaths, and we obtain immediately a cable, subject to the joint question being satisfactorily solved, suitable for a voltage of 250,000 volts without exceeding a maximum potential gradient anywhere of more than 50 kV/cm, and this, too, with a 0.15 sq. in. copper core.

As already pointed out, a cable has been made, designed only for 150,000 volts, which has come through "smiling" after a test equivalent to 338,000 volts maintained for three-quarters of an hour; and working on identical lines and similar calculations (which, as I have already shown, err on the safe side) we ought to be able to design a cable for 220,000 volts with an overall diameter under the lead of 4¼ in. or, say, 5¼ in. over the lead.

In any case, a cable has been *made* which appears to be thoroughly serviceable for 150,000 volts, and is only 2¾ in. diameter under the lead. This, I believe, it is quite beyond the possibility of single-core cables to accomplish for equal limiting stress and for an equally small core cross section.

A. M. Taylor.
Major S.O.2.

Erdington, *July 19th*, 1924.

A Modern Electric Flat.

I have read Mr. Robinson's latest outburst in your issue of the 11th instant that his borough is becoming a sort of "City Electra." Surely Mr. Robinson does not really believe that the dawn of all-electric homes has at last arrived. If he does, then his statement is based on hypothesis plus the assumption that the local gas undertaking has been like Rip Van Winkle.

No! Mr. Robinson's dream that electricity is the fuel of the future cannot possibly be. It would be criminal to suggest it. If electricity could show an 80 per cent. efficiency instead of 10 per cent. then he could introduce a loud speaker; until then it would be advisable not to make extravagant claims.

Having been connected with both the electricity and the gas business, I have come to the conclusion that "juice" has its uses, but heating and cooking are not two of them. Certain inexperienced electrical advocates state that by cooking with gas in lieu of electricity:—

(*a*) There is a bigger shrinkage in the meat roasted.
(*b*) The food cooked in the oven is tainted.
(*c*) There is a danger of being gassed.

There are many other reasons stated, none of which have any foundation. I am convinced that if a test were carried out in my home town, or even Hackney, between a gas and an electric cooker, the latter would be a poor second. Possibly Mr. Robinson may agree with me. Should he, however, still believe that electric cooking is:—

(1) More convenient.
(2) Cleaner.
(3) Cheaper, or even as cheap to cook with as gas,

then possibly he would be prepared to come forward and prove his statements in public by actual test against the gas cooker. The tests could be carried out in Scotland or England. Being the challenger, I will leave the selection of the town to Mr. Robinson.

Should the gas cooker fail, I will bear all the expense, and no doubt Mr. Robinson will do likewise should he fail. By having a public test carried out we will arrive at some definite conclusion that cannot possibly be obtained through the columns of your journal.

Sam. Hall.

Leith, *July 16th*, 1924.

"Cuisinier" is requested to forward his name and address.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

34,576. "Radio apparatus tuning mechanism." W. H. Huth. December 19th, 1922. (Convention date not granted.) (197,911.)
35,079. "Electric switches." J. A. Crabtree. December 23rd, 1922. (217,939.)

1923.

1,877. "Wireless transmission and reception." E. T. Fisk. January 30th, 1923. (217,942.)
2,086. "Train-control apparatus." E. C. R. Marks (Clifford International Corporation). January 23rd, 1923. (217,946.)
3,663. "Electrically-heated mats." J. R. Quain. February 7th, 1923. (217,950.)
4,981. "Condensers, resistances, and like variable electrical devices." W. Dubilier. February 20th, 1923. (217,951.)
7,781. "Electrically-actuated fire detector and alarm." H. M. Lorrain. March 19th, 1923. (217,967.)
7,928. "Sockets for thermionic valves, electric lamps, and like apparatus." Western Electric Co., Ltd., and B. B. Grace. March 20th, 1923. (217,972.)
8,154. "Electrical switches." I. H. Parsons. March 22nd, 1923. (217,975.)
8,448. "Telephone systems." Siemens Bros. & Co., Ltd., J. Berry, and C. L. Peters. March 24th, 1923. (217,981.)
8,492. "Electric welding machines." British Insulated & Helsby Cables, Ltd., S. C. Bullock, and L. B. Wilson. March 26th, 1923. (217,984.)
8,584. "Control of vehicles provided with electrical transmission." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 26th, 1923. (217,989.)
8,585. "Electrical braking of vehicles." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 26th, 1923. (217,990.)
8,873. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. March 28th, 1923. (Addition to 140,134.) (218,005.)
8,901. "Means for electrically indicating and recording weighments." H. Pooley & Son, Ltd., and J. Dobson. March 29th, 1923. (218,006.)
9,130. "Electric resistances or rheostats." C. Seymour and G. W. Harris. April 3rd, 1923. (218,020.)
9,249. "Ignition apparatus for internal-combustion engines." C. H. Claudel. April 11th, 1922. (196,270.)
9,752. "Electric fuses." Holmes & James, Ltd., and H. E. Sutherland. April 10th, 1923. (218,030.)
9,782. "Loud speakers for use in wireless telephone apparatus." Johnson and Phillips, Ltd., and W. H. Johns. April 10th, 1923. (218,031.)
10,208. "Wireless receiving apparatus." A. MacLennan. April 14th, 1923. (218,037.)
10,333. "Sound-emitting or transmitting instruments." British Thomson-Houston Co., Ltd., A. P. Young, and J. H. Butcher. April 16th, 1923. (218,038.)
12,032. "Electric couplings." J. H. Bradley. May 4th, 1923. (218,059.)
12,319. "Rheostats." W. J. Davis and Edison Swan Electric Co., Ltd. May 8th, 1923. (218,063.)
12,343. "Means for maintaining the insulation resistance of electric cables and the like." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. May 8th, 1923. (218,064.)
12,458. "Thermionic valve apparatus." E. A. Graham and W. J. Rickets. May 9th, 1923. (218,066.)
15,202. "Current limiters." E. Schattner. June 11th, 1923. (218,085.)
15,235. "Electrical means for automatically controlling the temperature in pasteurising, evaporating, drying, and such-like operations." T. L. Jones. June 11th, 1923. (218,086.)
15,710. "Electrically-heated steam and vapour generators." British Thomson-Houston Co., Ltd. (General Electric Co.). June 16th, 1923. (218,089.)
17,120. "Insulation of electric conductors." Sachsenwerk Licht-Und Kraft Akt. Ges. February 20th, 1923. (211,822.)
17,416. "Crystal detectors for wireless telegraphy and telephony receiving apparatus." H. H. Parkin, G. Parkin, W. Parkin, and F. Parkin. July 5th, 1923. (218,106.)
18,425. "Thermionic valve for use more particularly in wireless telegraphy or telephony." W. R. Bullimore. July 17th, 1923. (Addition to 192,464.) (218,116.)
18,482. "Means for connecting submarine cables to junction boxes." Felten and Guilleaume Carlswerk Akt. Ges. July 17th, 1922. (200,843.)
18,884. "Coated cores, and method of producing same." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 23rd, 1923. (218,122.)
19,983. "Electronic discharge tubes." Compagnie Pour La Fabrication Des Compteurs et Matériel D'Usines à Gaz. August 7th, 1923. (201,939.)
21,831. "Detachable clamps for connecting electric leads to overhead conductors." Rail Welding Co., Ltd. (B. J. J. Glaezel). August 29th, 1923. (218,153.)
26,269. "Electric switches." J. A. Crabtree. December 23rd, 1922. (Cognate application, 10,528/23.) (Divided application on 217,939.) (218,172.)
28,728. "Apparatus for translating pressure variations into electrical variations." Westinghouse Electric & Manufacturing Co. November 14th, 1922. (207,182.)
29,003. "Tanks for electrical or other apparatus." Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1922. (209,047.)
29,613. "Automatic reclosing circuit-breaker systems." British Thomson Houston Co., Ltd. November 23rd, 1922. (207,549.)
30,629. "Electric terminals." C. O. Alexander, C. B. Johnson, and T. W. Simpson. December 5th, 1923. (218,191.)
31,048. "Portable electric inspection lamps." W. W. Carroll. December 10th, 1923. (218,193.)
31,870. "Electric heating units." British Thomson-Houston Co., Ltd. December 20th, 1922. (208,708.)
32,446. "Insulators." O. Rosing. December 28th, 1923. (218,203.)

1924.

2,282. "Electric mine fuses." N. E. Schmitt and O. Schmitt. January 28th, 1924. (218,218.)
2,478. "Means for the production or reproduction of sound or like vibrations." S. G. Brown. February 22nd, 1923. (Divided application on 211,183.) (218,221.)
4,921. "Electrical protective devices." Metropolitan-Vickers Electrical Co., Ltd. March 5th, 1923. (212,537.)

Domestic Welfare Exhibition.—The Glasgow Corporation has arranged to hold a Domestic Welfare Exhibition in the Kelvin Hall during the three weeks commencing October 13th. The exhibits will include lighting, heating, and labour-saving appliances.